BRITISH COLUMBIA

COASTAL FISHERIES FORESTRY GUIDELINES

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B.C. Ministry of Forests and Lands
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British Columbia
Coastal Fisheries/Forestry
Guidelines

Table of Contents

1. Preface

2. Statement of Principles

3. Stream Reach Specifications and Objectives

4. Field Guide

5. Reference Guide

6. Appendices
   - I Interagency Agreement on Resource Management Conflict Resolution between the Ministry of Forests and Lands, the Ministry of Environment and Parks and the Department of Fisheries and Oceans.
   - II General Freshwater and Estuary Residence and/or Utilization for Pacific Salmonids.
   - III Administrative Arrangements for Implementing the Coastal Fisheries/Forestry Guidelines.
   - IV Rationale for Stream Reach Classification for the Guidance of Forest Practices in Coastal British Columbia.
   - V Minimum Road Specs
   - VI Administration and Issuance of Permits Pursuant to B.C. Gravel Removal Order.
   - VII Guidelines for Aerial Application of Pesticide in B.C.
   - VIII Erosion Control Procedures for Forest Roads and Degraded Slopes in B.C.
   - IX Protection Methods when using Aerial Application of Fertilizer near Fertilizer Free zones.
   - X Revised Pre-Harvest Silviculture Prescription.
   - XI Fire Services Act and B.C. Fire Code Regulations.
   - XII Glossary.

PREFACE

The Coastal Fisheries/ Forestry Guidelines were developed by industry and the agencies that jointly have direct control over integrated resource management in coastal watersheds. The purpose of the Guidelines is to provide a common basis for applying joint management principles to assist the agencies in achieving their respective objectives. Because these objectives are, to some degree, competitive and conflicting, their mutual full achievement will not always be possible within practical operating constraints.

The Guidelines consist of six documents. The first is a 'Statement of Principles' which outlines a number of operating principles with respect to management issues. Attached to this is a definition of the four classes of stream reach and associated fish habitat management objectives. The third document is an 'Field Guide' which summarizes the major guidelines for all aspects of forestry operations to protect fish habitats in accordance with stream reach class objectives. This guide will act as a ready reference in the field. Additional detail and examples are presented in the 'Reference Guide'. The balance of the documentation is a glossary of terms used in the Guidelines and a set of appendices that contain special technical information and approved regulatory procedures established by government agencies.

These guidelines are not intended to be complete or definitive. They have been developed by consensus based on past operating experience and the most current research information. After being used for a trial period of two years throughout coastal British Columbia, these guidelines will be evaluated, refined and adjusted as required.

Finally, it should be emphasized that these Guidelines do not override or nullify the legislative mandate of management agencies. They serve to guide established management processes, but clear violations of these mandates will continue to be dealt with through existing legal procedures. Hopefully, the presence of the Guidelines will reduce such occurrences to a minimum.

COASTAL FISHERIES/FORESTRY GUIDELINES

A STATEMENT OF PRINCIPLES

The concept of integrated resource management recognizes that both forestry and fisheries share a common watershed base, and that strategies which enable the sustained development of timber and fisheries resources through protecting their productive capabilities will generate a higher net benefit than single resource use. The objective of the Coastal Fisheries/Forestry Guidelines is, therefore, to maximize the net benefits of the combined fisheries and forestry resources, while minimizing time and cost.

The Coastal Fisheries/Forestry Guidelines have been developed to assist in integrating fisheries and forestry management in coastal British Columbia. They are intended to improve the performance and effectiveness of the consultative process required for fish habitat protection and concurrent forest harvesting management, but they are not intended to replace ongoing site inspections that are such an important aspect of integrated fisheries/forest management. Hence, these Guidelines strengthen the developing cooperation between resource management agencies and the forest industry.

Based on this statement of philosophy, the Coastal Fisheries/Forestry Guidelines warrant additional perspective and comment:

1. Forest management related to a range of fisheries value:

   The stream reach classification system identifies a range of fisheries habitat values and is used as the basis for determining related forest management practices in watersheds. The objective of these Guidelines, as stated above, can be achieved by integrating forest harvesting practices with fish habitat values.

   Highest value fisheries habitats (Class I) require the highest level of management effort, from both fisheries and forest managers, to maintain productive capabilities. Lowest value habitats (Class IV) require minimal protection, with fisheries protection measures limited to those required in consideration of downstream impacts on higher class reaches.

   Use of these guidelines requires that stream reaches be classified for each watershed. Existing fisheries information is sufficient to determine stream reach classes in many watersheds but in some watersheds additional inventory will be required. The required information will become available as the federal/provincial fish habitat inventory and information program is implemented. Occasional situations may arise where industry must change operational plans and move quickly into watersheds with no inventory adequate for stream classification; under such circumstances, industry and government would cooperate in obtaining the necessary inventory. Habitat management objectives are based on the stream reach class, and assist in determining appropriate forest management practices. Where information obtained during forest operation development will occasion reclassification to a higher order stream, adjustments to objectives may be necessary in consideration of the extent of the development that has already been committed.

The stream reach classification system and the associated guidelines are based on a synthesis of research information from the Pacific Northwest(Oregon to Alaska) combined with field experience derived from the fisheries and forestry agencies and the forest industry. They support the development of on-site management decisions, and indicate where management attention should be focused.

2. Basis for Stream Classification:

The value of stream habitats determines the stream reach class and includes consideration of fisheries management plans which have been approved at the Director level of Government for upgrading of specific reaches. Stream reaches programmed for enhancement will be assigned the appropropriate higher class. Stream reaches not in the current program for enhancement at the time of logging plan development will be managed consistent with their present classification.

3. Rate of Cut Consideration:

While these guidelines address immediate site specific practices, the time period over which forest development plans apply may be less than that required for some biological and physical processes to occur. Consideration may, therefore, be required of the total area of timber harvested in a watershed over a given period of time. This rate of cut issue is presently being addressed by a fisheries-forestry technical committee. When the report is released and accepted, any pertinent recommendations will be included in these guidelines.

4. Resolving Conflicts and Uncertainty:

Even the best integrated management process can suffer from inadequate information or differences of opinion. The application of these guidelines will therefore always be guided by professional judgement and by common sense leading to the development of site-specific solutions to problems. When uncertainty exists, degree of risk and magnitude of potential effect on habitat must be considered and appropriate decisions made to minimize impact.

In the case of disagreement which cannot be resolved at the operational level, guidance from successively higher levels of management will be sought in accordance with the Interagency Agreement on Resource Management Conflict Resolution between the Ministry of Forests and Lands the Ministry of Environment and Parks and the Department of Fisheries and Oceans (Appendix I).

5. Training and Information Requirements:

Understanding the stream classification system, taking management decisions in the field and making use of tools available to fisheries and forestry managers, require education and training. Training programs will be conducted for all involved staff to facilitate mutual understanding of these guidelines and their effective application in the field.

A Field Guide for field staff has been developed which, in combination with this Statement of Principles and the Reference Guide, will form the Coastal Fisheries/Forestry Guidelines. These guidelines will be reviewed and updated as required and the training programs will be repeated from time to time.

6. Monitoring and Evaluation:

The effectiveness of these guidelines in terms of achieving their objective for maximizing net benefits will be monitored. This monitoring program will include assessing costs to the forest resource to protect fisheries habitat values, the degree to which fish habitat objectives have been achieved, and the efficiency in reducing and resolving conflicts and making management decisions in the field.

STREAM REACH SPECIFICATIONS AND OBJECTIVES

Class I

Anadromous salmonids or moderate to high levels of resident sports fish are present, or the reach has been identified for upgrading in an approved fisheries management plan. Stream gradient is usually less than 8%. The objective is to maintain productive capacity of the fish habitats including water quality and stream channel characteristics. To provide flexibility, it may be necessary to design compensating or mitigating measures which offset the unavoidable effects which even careful forest harvesting may have on a stream system.

Class II

Low levels of resident sport fish are present. Stream gradient is usually 8%-12%. The objective is to minimize loss of productive capacity of the fish habitats and maintain sufficient stream channel integrity to protect Class I reaches from accelerated transport of sediment or debris.

Class III

Resident non-sport fish are present. Stream gradient is usually 8%-20%. The objective is to maintain the genetic stock of indigenous species and maintain sufficient stream channel integrity to protect Class I, and Class II reaches which may be impacted from accelerated transport of sediment or debris.

Class IV

No fish are present and stream gradient is usually greater than 20%. The objective is to maintain sufficient stream channel integrity to protect Class I, and Class II reaches which may be impacted from accelerated transport of sediment or debris.

COASTAL FISHERIES/FORESTRY GUIDELINES

FIELD GUIDE

The Field Guide has been developed for field use. The Reference Guide is available for expansion of the subject matter and provision of examples.

The following presents the planning and operational guidelines applicable to the four Stream Reach Classes for each forest harvesting and silvicultural phase. As early as possible, industry should identify proposed areas for logging which require additional information for stream classification in order to identify important stream values when information is not available. All phases of harvesting should be planned with due consideration to the distribution of stream reach classes and the potential for downstream impacts in the watershed. Sufficient data should be acquired which are pertinent to all phases of forest management activities, such as maps of bedrock geology, surficial geology, soil types and stability hazards. These maps should be used to identify potentially unstable slopes for which more detailed studies may be required.

The stream reach classes to which guidelines are applicable are indicated by]]] . An • indicates that the guidelines apply only when class I or II reaches downstream may be impacted.

	STREAM REACH CLASS			
	I	II	III	IV
A. PLANNING AND CONSTRUCTION FOR ROADS AND LANDINGS:				
Consider the logging system, logging pattern and special road building techniques to permit efficient forest development and harvesting while optimizing environmental protection.				
Considerations required to achieve this are:				
• constructing roads reasonable distances from Fisheries Sensitive Zones.	]]]]]]]	•	•	
• avoiding construction in highly sensitive areas of slope instability unless Agency approval obtained.	]]]]]]]]]]]]]]]]]]			
• stopping construction during extremely unfavorable soil moisture conditions and making necessary modifications to minimize erosion.	]]]]]]]	•	•	
• avoiding deposit of construction debris or sidecast material into waterbodies or where it may enter a waterbody.	]]]]]]]	•	•	
• scheduling construction to take into account fish life cycles and water flows.	]]]]]]]	•	•	
B. RIGHT-OF-WAY FELLING, CLEARING AND SUBGRADE CONSTRUCTION:				
Emphasis to be placed on the falling patterns and construction techniques to minimize sedimentation, rock, and organic debris impacts on streams.				
Considerations required to achieve this are:				
• falling right-of-way trees away from stream reaches.	]]]]]]]	•	•	

	STREAM REACH CLASS I	II	III	IV
• selecting suitable material, equipment, and techniques.	]]]]]]]	•	•	
• providing adequate subgrade drainage.	]]]]]]]	•	•	
• maintaining slope stability during subgrade construction.	]]]]]]]	•	•	
• preventing, where practical, blasted rock from entering waterbodies.	]]]]]]]			
• stopping operations if a slide occurs which enters or may enter a waterbody, and notifying the Forest Officer immediately.	]]]]]]]	•	•	

C. BALLASTING AND SURFACING:

Emphasis to be placed on minimizing road surface erosion.

Considerations required to achieve this are:

• using suitable surface materials.	]]]]]]]]]]]]]]]]			
• the road surface must be above water table during the operating period.	]]]]]]]	•	•	

D. PITS AND QUARRIES:

In developing road surface materials, considerations required are:

• controlling drainage of water or other deleterious products from pits and quarries.	]]]]]]]	•	•	
• obtaining approval of a Fisheries Officer for gravel removal from the stream channel.	]]]]]]]	•	•	

E. FUEL STORAGE:

Avoid fuel spillage or the potential for spillage during fuel storage and fueling operations.	]]]]]]]]]]]]]]]]]			

F. CUTS AND FILLS:

Emphasis to be placed on avoiding sediment additions which have the potential to directly affect stream channels.

Considerations required to achieve this are:

• stable angle of repose.	]]]]]]]	•	•	
• road and sidecast stability.	]]]]]]]	•	•	
• initiating stabilization efforts immediately on steep slopes.	]]]]]]]	•	•	

G. DRAINAGE, INCLUDING BRIDGES AND CULVERTS:

Emphasis to be placed on drainage design and construction to minimize stream sedimentation and maintain channel integrity.

Considerations required to achieve this are:

• identifying continuous and intermittent streams during time of road survey.	]]]]]]]]]]]]]]]]]			

	STREAM REACH CLASS I	II	III	IV
• ensuring that the drainage design is adequate to handle interrupted surface and sub-surface flows.	]]]]]]]]]]]]]]]]]]]			
• installing sufficient culverts to prevent ditch erosion, and in a manner to prevent outflow erosion.	]]]]]]]]]]]]]]]]]]]			
• providing adequate drainage for water courses concurrently with subgrade construction and installing all drainage structures by the time ballasting is completed.	]]]]]]]]]]]]]]]]]]]			
• designing culvert and bridge capacity to avoid channel scouring and road washouts.	]]]]]]]]]]]]]]]]]]]			
• maintaining width and gradient of active stream channels with preference for the use of wooden culverts or pipe arches for fish passage.	]]]]]]]]			
• maintaining bridge abutments above the high water mark of the stream channel.	]]]]]]]]	•	•	
• satisfying fish life cycle timing and activity constraints for bridge construction.	]]]]]]]]	•	•	
• satisfying instream equipment operation constraints for bridge construction.	]]]]]]]]	•	•	
• clearing culverts and bridges of debris.	]]]]]]]]]]]]]]]]]]]			

H. MAINTENANCE OF LOGGING ROADS:

Emphasis to be placed on retention of the road surface and drainage structure integrity.

Considerations required to achieve this are:

• conducting intensive maintenance as per MOFL minimum road specifications prior to long shutdowns and peak stream flow periods.	]]]]]]]]]]]]]]]]]]]			
• leaving roads, drainage structures, and water courses in a condition suitable to minimize erosion following harvesting.	]]]]]]]]]]]]]]]]]]]			

I. PLANNING AND OPERATIONS FOR FALLING AND YARDING:

Emphasis to be placed on minimizing stream sedimentation and maintaining streambank and channel integrity.

Considerations required to achieve this are:

• providing available physical and environmental information or interpretative data for each opening during the preparation of a Five-Year Development Plan submission.	]]]]]]]]]]]]]]]]]]]			
• evaluating landslide and erosion hazards and utilizing special measures where required.	]]]]]]]]]]]]]]]]]]]			
• choosing appropriate yarding systems for the site, yarding uphill where practical.	]]]]]]]]]]]]]]]]]]]			

	STREAM REACH CLASS I	II	III	IV
GROUND-SKIDDING SYSTEMS:				
Emphasis is to be placed on minimizing stream sedimentation and maintaining streambank and channel integrity.				
Considerations required to achieve this are:				
• thoroughly assessing whether to utilize this system on slopes greater than 30%.	]]]]]]]]]]]]]]]]			
• locating of major skid roads to avoid continual and random stream crossings, erodible soils and continuous steep grades.	]]]]]]]]	•	•	
• suspending operations where required during high soil moisture conditions.	]]]]]]]]	•	•	
• avoiding Fisheries Sensitive Zones with skid roads.	]]]]]]]]			
• avoiding active or ephemeral streams and zones of seepage with landing locations.	]]]]]]]]	•	•	
STREAMSIDE AREAS:				
Emphasis will be placed on maintaining streambank and habitat integrity.				
Considerations required to achieve this are:				
• protecting Fisheries Sensitive Zones.	]]]]]]]]			
• evaulating potential window hazard and impacts.	]]]]]]]]	•	•	
• undertaking instream activities in recognition of timing windows relative to fish life cycles and water flows. (See Reference Guide 2.5.4)	]]]]]]]]	•	•	
• needing to delineate and protect a streamside management zone or leave strip.	]]]]]]]]			
• retaining mature trees to maintain stability of the channel and L.O.D. sources and to prevent forest site loss on major class III and IV streams.				]]]]]]]]
• employing agency approved directional falling and yarding techniques.	]]]]]]]]	•	•	
• for cross-stream yarding consider:				
I) stream bank stability II) instream L.O.D. III) stream capability to transport debris				
If banks are unstable, the area has gullied terrain with deep soils, or L.O.D. is stabilizing the channel and logging may disturb or destabilize these conditions, then fall and yard away.	]]]]]]]]	•	•	
If banks are stable and the channel is not stabilized by L.O.D., then consider the potential for falling across and yarding over the channel subject to debris transport capability evaluation and possible debris removal requirements.			•	•
• preventing the introduction of debris (fall away, yard away).	]]]]			
• using streams as lateral boundaries for yarding roads.	]]]]]]]]			

	STREAM REACH CLASS I	II	III	IV
• carefully supervising recommended stream cleanup.	]]]]]]]	•		•
• evaluating impacts of harvesting operations on downstream values.			]]]]]]]	
• taking streambank or slope stabilization measures following logging in the event of instability or accelerated erosion.	]]]]]]]]]]]]]]]]]]			

L. PLANNING AND OPERATIONS FOR SILVICULTURE:

Emphasis will be placed on permitting efficient reforestation while optimizing environmental protection.

Considerations required to achieve this are:

• identifying silvicultural requirements for problem sites at the time of preharvest assessment.	]]]]]]]	•		•
• selecting strategies and equipment to minimize ground disturbance where brush competition and erosion are problems.	]]]]]]]	•		•
• protecting established streamside management zones, Fisheries Sensitive Zones, or leave strips during post-harvesting treatment.	]]]]]]]]]]]]]]]]]]			
• controlling chemical applications in accordance with the Pesticide Control Regulations.	]]]]]]]]]]]]]]]]]]			
• avoiding brush control on unstable sites where live root systems are required for stability.	]]]]]]]]]]]]]]]]]]			

M. BRUSH AND STREAMSIDE DECIDUOUS TREE CONTROL:

Emphasis will be placed on protection of Fisheries Sensitive Zones during pesticide applications and retention of streamside vegetation for erosion control, cover and streambank stability.

Considerations required to achieve this are:

• determining the need for alder seed tree control during preharvest assessment.	]]]]]]]			
• implementing brush control programs.	]]]]]]]	•		•
• assessing the contribution of streamside vegetation to stream productivity and streambank and channel stability prior to a decision to remove. (Consult with Agencies' staff before proceeding.)	]]]]]]]	•		•
• considering timing sequence in extensive uniform stands of deciduous trees.	]]]]]]]	•		•
• promoting coppicing.	]]]]]]]	•		•
• conforming with Pesticide Use Permit and obtaining Fisheries Agencies approval for herbicide applications within 10 meters of the stream.	]]]]]]]]]]]]]]]]]]			
• protecting pesticide free zones as required by the Pesticide Use Permit.	]]]]]]]	•		•
• using ground-based treatments rather than aerial treatments where practical	]]]]]]]	•		•
• take all precautions to minimizing drift into pesticide free zones during aerial pesticide applications.	]]]]]]]	•		•

STREAM REACH CLASS
I II III IV

N. SCARIFICATION AND BURNING:

Emphasis will be placed on protection of streamside management zones and Fisheries Sensitive Zones.

Considerations required to achieve this are:

- keeping these activities away from protected zones, leave strips, and sites susceptible to erosion or debris transport from flooding.]]]]]]] • •
- avoiding disturbance to stream channel integrity in the use of equipment.]]]]]]]]]]]]]]]]

O. FERTILIZATION:

Emphasis will be placed on fertilizer applications to avoid detrimental effects on fisheries habitats.

This applies on a watershed basis for pelletized urea only

Considerations required to achieve this are:

- applying in fall or early winter preferred.
- determining the nutrient sensitivity and acceptable nitrogen loading of the watershed.
- avoiding during all phases of fertilizer handling, deposits into ditches and drainage channels, and fertilizer free zones.
- see 3.5.4 to 3.5.6 re fertilizer free zones.

COASTAL FISHERIES/FORESTRY GUIDELINES
REFERENCE GUIDE

The following presents the planning and operational guidelines applicable to the four Stream Reach Classes for each forest harvesting and silvicultural phase. As early as possible, industry should identify proposed areas for logging which require additional information for stream classification in order to identify important stream values when information is not available. All phases of harvesting should be planned with due consideration to the distribution of stream reach classes and the potential for downstream impacts in the watershed. Sufficient data should be acquired which are pertinent to all phases of forest management activities, such as maps of bedrock geology, surficial geology, soil types and stability hazards. These maps should be used to identify potentially unstable slopes for which more detailed studies may be required.

The stream reach classes to which guidelines are applicable are indicated by]]]. An ● indicates that the guidelines apply only when class I or II reaches downstream may be impacted.

	STREAM REACH CLASS I	II	III	IV
1.0 PLANNING AND CONSTRUCTION FOR ROADS AND LANDINGS:				
1.1 General				
1.1.1. Consider the logging system, logging pattern and special road building techniques, such as endhauling, to minimize soil disturbance. Plan road layout to permit efficient forest access development and harvesting, and environmental protection. Timing of construction or special measures should be related to the value of reach classes.	]	]	]	]
1.1.2. Take advantage of stable benches, ridge tops and gentle slopes. Avoid midslope roads wherever possible, particularly if a problem is identified.	]	]	]	]
1.1.3. Plan and construct roads a reasonable distance from Fisheries Sensitive Zones (see Glossary), to maintain vegetation and prevent instream damage and downstream sedimentation.	]	]	●	●
1.1.4. Construct roads to avoid areas with evidence of slope instability, unless the alignment is the best alternative and special design features which will prevent damage are incorporated into the plan. Where it is agreed by Agency staff that short sections of road must be constructed through highly-sensitive areas, there must be a critical evaluation with special construction restraints applied.	]	]	]	]
1.1.5. Stop construction during extremely unfavourable soil moisture conditions where siltation or debris will threaten fisheries values. Resume operations when conditions permit. It may be necessary to temporarily modify the site to ensure that erosion during the shutdown is minimized.	]	]	●	●
1.1.6. Avoid depositing construction debris or sidecast into any waterbody or at a location where it may subsequently enter a waterbody.	]	]	●	●

	STREAM REACH CLASS I	II	III	IV
1.2 Right of Way Felling, Clearing and Subgrade Construction:				
1.2.1. Give preference to the use of backhoes to minimize sidecasting and erosion in areas with steep slopes, unstable terrain, soils with low bearing strength, or high seepage. Crawler tractors should not be used in these areas.	]]]]]]]]]	•		•
1.2.2. Where possible, fall right-of-way trees away from stream reaches.	]]]]]]]]]	•		•
1.2.3. Stumps or organic material should not be incorporated into the subgrade where there is potential for failure into a watercourse.	]]]]]]]]]	•		•
1.2.4. Ensure that subgrade is adequately ditched and drained during construction. (See Sec 1.7)	]]]]]]]]]	•		•
1.2.5. Maintain slope stability during subgrade construction. If slides do occur during road construction, stop the operation and notify the Forest Officer immediately.	]]]]]]]]]	•		•
1.2.6. Where possible, rock from blasting operations should not enter stream reaches.	]]]]]]]]]			
1.3 Ballasting and Surfacing:				
1.3.1. Minimize road surface erosion by the use of suitable surface materials for the anticipated speed and traffic frequency.	]]]]]]]]]]]]]]]]]			
1.3.2. The ballast should be of sufficient depth to elevate the road surface above the water table during the operating period.	]]]]]]]]]	•		•
1.4 Pits and Quarries:				
1.4.1. Control water drainage from pits and quarries to prevent eroded material or other deleterious products from entering streams.	]]]]]]]]]	•		•
1.4.2. Gravel removal from the stream channel requires approval of a Fisheries Officer. (See Gravel Removal Order in Appendix VI.)	]]]]]]]]]	•		•
1.5 Fuel Storage:				
1.5.1. Avoid fuel spillage or the potential for spillage when storing fuel and during fuelling operations.	]]]]]]]]]]]]]]]]]			
1.5.2. Construct impermeable berms around storage areas to comply with existing government regulation (Appendix XI.)	]]]]]]]]]]]]]]]]]			
1.6 Cuts and Fills:				
1.6.1. Avoid cuts and fills which have the potential to directly affect stream channels; however, if considered absolutely necessary, ensure that: a) Cut and fill slopes are designed and constructed at a stable angle of repose or less. (See Minimum road specs, Appendix V.) b) Full bench construction is recommended on steep slopes and sensitive sites. c) Sidecasting is not carried out on or above areas with potentially unstable accumulations of organic debris. d) On steep cut and fill slopes in sensitive areas, stabilization efforts are to be initiated immediately (e.g. terracing, revegation, cribwork, slope rounding).	]]]]]]]]]	•		•

	STREAM REACH CLASS I	II	III	IV
1.7 Drainage, Including Bridges and Culverts: (See Appendix V, Min. Road Specs.)				
1.7.1. Identify continuous and intermittent streams for drainage planning purposes at the time of road survey and determination of location.	]]]]]]]]]]]]]]]]]]]			
1.7.2. Ensure that the road drainage design is adequate for the handling of interrupted surface and sub-surface water flows. Install sufficient culverts to reduce the volume of ditch water and prevent ditch erosion, especially where significant groundwater is intercepted on steep slopes.	]]]]]]]]]]]]]]]]]]]			
1.7.3. Provide adequate drainage for watercourses concurrently with subgrade construction and install all drainage structures (see Glossary) by the time ballasting is completed.	]]]]]]]]]]]]]]]]]]]			
1.7.4. Provide adequate drainage at all road junctions.	]]]]]]]]]]]]]]]]]]]			
1.7.5. The use of wooden culverts or pipe arches is preferred to provide for fish passage. Other provisions include: a) The design of drainage structures to maintain the width of the active stream channel. b) The maintenance of the natural stream gradient under the crossing structure (metal pipes should be partially buried in the streambed).	]]]]]]]]]			
1.7.6. When erosion is expected, direct culvert outflow to natural channels, non-erodible surfaces or suitable energy dissipating devices.	]]]]]]]]]	•	•	
1.7.7. Construct catch basins at culvert intakes of sufficient size to collect transported sediment and debris.	]]]]]]]]]]]]]]]]]]]			
1.7.8. Clear debris from catch basins and channels, preferrably during low flow conditions, to prevent blockage of culverts.	]]]]]]]]]]]]]]]]]]]			
1.7.9. Design culvert and bridge capacity of adequate size to avoid channel scouring and road washouts.	]]]]]]]]]]]]]]]]]]]			
1.7.10. Satisfy recommended timing constraints for construction. (See Appendix II and guideline 2.5.4.)	]]]]]]]]]	•	•	
1.7.11. Bridge abutments should not encroach within the high watermark of the stream channel.	]]]]]]]]]	•	•	
1.7.12. Bridge construction should avoid scour, siltation, erosion and stream habitat damage.	]]]]]]]]]	•	•	
1.7.13. Minimize the use of machines in streams. Stream fording with equipment should be at one location only. Obtain approval for the instream operation of equipment from the Fisheries Agencies.	]]]]]]]]]			
1.7.14. Obtain approval for instream operation of equipment from Fisheries Agencies for bridge construction in areas of sensitive soils.			•	•
1.8 Maintenance of Active Use Logging Roads: (See Glossary)				
1.8.1. Retain the integrity of the road surface, drainage structures and water quality throughout the maintenance program.	]]]]]]]]]]]]]]]]]]]			
1.8.2. Conduct intensive maintenance as per MOFL minimum road specifications prior to long shutdowns and peak stream flow periods, e.g. culvert and ditch cleanout, cross ditching, etc.	]]]]]]]]]]]]]]]]]]]			

STREAM REACH CLASS
I II III IV

1.9 Maintenance of Inactive Logging Roads: (See Glossary)

Identify roads after harvesting as either "limited access" or "abandoned".

1.9.1. Limited Access Roads (See Glossary)

]]]]]]]]]]]]]]]]]]]]

Take the following steps for long term road stabilization:

a) Remove culverts that demonstrate a serious maintenance problem.
b) Cut cross ditches to further reduce the volume of ditch water and to re-establish natural flow patterns.
c) Where openfaced culverts or cross drains are used on inactive roads (for waterflow across the road), provide for a non-erodible armouring surface.

1.9.1. Abandoned Roads (See Glossary)

]]]]]]]]]]]]]]]]]]]]

Take the following steps for permanent road stabilization:

a) Leave roads in a condition suitable to minimize erosion, e.g. remove culverts and road fill material from gullies and stream channels to permit open flow and stable channel conditions. Revegetation may be required.
b) Stabilize existing surface drainage patterns and deposit excavated material in a stable location.
c) Frequent cross ditches may be required on steep grades.

STREAM REACH CLASS
I II III IV

2.0 PLANNING AND OPERATIONS FOR FALLING AND YARDING:

2.1 General:

2.1.1. Include the following information and/or interpretations, when available, during the preparation of a Five Year Development Plan: location, extent and configuration of blocks; topographic details; windthrow potential; landing locations; season of extraction; terrain stability maps or data; E.S.A. information; and any other relevant data to identify high risk areas.]]]]]]]]]]]]]]]]]]

2.1.2. Evaluate landslide and erosion hazards in steep or otherwise unstable areas where a relatively small disturbance may lead to a debris torrent, mass wasting or erosion problem (slumps, landslides, rilling, etc.). Where these hazards exist, harvesting will require special measures.]]]]]]]]]]]]]]]]]]

2.1.3. Cable yarding or aerial (helicopter and balloon) systems are preferred as they create less ground disturbance.]]]]]]]]]]]]]]]]]]

2.1.4. Yard uphill wherever possible to minimize the risk of yarding across or adjacent to streams and to minimize the valley bottom concentration or convergence of erosion channels that may be caused by downhill yarding.]]]]]]]]]]]]]]]]]]

2.2 Ground Skidding Systems:

2.2.1. Generally, these systems should not be employed on slopes greater than 30%.]]]]]]]]]]]]]]]]]]

2.2.2. Prevent soil erosion and resulting stream sedimentation and preserve the natural streambank integrity, water flow and water quality by:]]]]]]]]] • •
a) Locating major skid roads prior to the commencement of skidding, especially for winter skidding operations, to avoid continual and random stream crossing. Choose locations that avoid erodible soils.
b) Minimizing the length of skid roads to reduce erosion potential.
c) In areas which have erosion problems during high soil moisture conditions, suspending skidding operations.

2.2.3. Locate landings away from active or ephemeral streams or zones of soil seepage.]]]]]]]]] • •

2.2.4. Design skid roads to avoid Fisheries Sensitive Zones, e.g. active flood plains, stream bottoms, etc. (See Glossary.)]]]]]]]]]

2.2.5. Avoid skid roads with continuous steep grades. Where steep grades are necessary, construct water bars to divert runoff to undisturbed areas.]]]]]]]]] • •

2.3 Helicopter or Balloon Systems:

2.3.1. Plan helicopter or balloon yarding systems considering the effects of flight paths, block configuration and staging areas on potential slash accumulation and debris fallout problems, to ensure water systems are not polluted or obstructed.]]]]]]]]] • •

2.3.2. Apply debris management guidelines when flight lines are over open water, including stream channels.]]]]]]]]] • •

	STREAM REACH CLASS I	II	III	IV
2.3.3. Limb at the setting.	]]]]]]]]]]]]]]]]]]			
2.3.4. Locate drop sites away from Fisheries Sensitive Zones such as estuaries and shellfish beds, or productive lake littoral zones.	]]]]]]]]]			
2.3.5. Locate drop sites and log handling areas beyond the littoral zone in both marine and freshwater systems (or beyond 10 m depth).	]]]]]]]]]			
2.3.6. Recover floating and sinking debris in Fisheries Sensitive Zones to reduce the physical impact and chemical contamination of the water. This could involve: a) Perimeter containment booms. b) Periodic surface sweeping of the drop area. c) Dredging of the bottom debris. d) Disposal of debris by burning or transport to an acceptable location.	]]]]]]]]]			

2.4 "A" Frame and Handlogging Systems:

2.4.1. "A" frame and handlogging operations have the potential to physically damage the site or deposit large quantities of debris in water. Therefore, only consider them in deeper water locations (beyond the 10 meter depth) well away from Fisheries Sensitive Zones.				
2.4.2. Take the following measures to reduce any potential slash and debris problems: a) Employ perimeter containment booms. b) Minimize falling into the water. c) Buck and limb on land. d) Remove contained debris and either place it back on shore in a stable location or dispose of it at an acceptable location.				

2.5 Streamside Areas

2.5.1. Protect Fisheries Sensitive Zones. (See Glossary.)	]]]]]]]]]			
2.5.2. Consider the impacts of harvesting operations on downstream values, e.g. Fisheries Sensitive Zones, community water supply, etc.				]]]]]]]]]
2.5.3. Consider the potential for windthrow and the consequences if it should occur, e.g. special circumstances such as high windthrow risk will require consideration that only one side of a valley be developed at one time and development of the remaining side be delayed until the logged areas have stabilized.	]]]]]]]]]	•	•	
2.5.4. Take timing constraints into consideration relative to fish life history phases, expected stream flows, debris management, operations on floodplains or extremely wet soil moisture conditions. Preference is given to periods of summer low flow for instream activities. Consultation with the local DFO and MOE&P staff may afford site specific variation, e.g. "Operating Window" usually relates to June 1 - September 15; Queen Charlotte Islands: June 1 - August 15. (See Appendix II.)	]]]]]]]]]	•	•	
2.5.5. Delineate and protect a streamside management zone (see Glossary) or leave strip which will provide: streambank and riparian vegetation stability; future source of large organic debris (L.O.D. See Glossary).	]]]]]]]]]			

STREAM REACH CLASS
I II III IV

2.5.6. To prevent forest site loss on major Class III and IV streams where bank stability or large organic debris is playing a significant role in stabilizing the channel, mature streamside trees may be required as a future source of L.O.D. Heavy leaners, snags and danger trees will often serve this purpose.]]]]]]]]]

2.5.7. In streamside areas prone to blowdown, employ directional falling to remove merchantable trees. Heavy leaners and danger trees may be either left standing or fallen directly across the stream based on an on-site inspection with Fisheries Agencies. Where yarding of these trees will create streambank or in-stream damage, leave a portion of the stem (a "bridge") spanning the creek in a stable position. This may apply to major streams of Class III and IV.]]]]]]]]] • •

2.5.8. The streamside management zone may include protection of snags, where compatible with Workers' Compensation guidelines, or leaving of non-merchantable trees as a future supply of snags or L.O.D. In addition, non-merchantable conifers or alder may have to be retained in the streamside zone to provide nest sites for cavity nesting birds and perching, or nest sites for raptors (see Glossary).]]]]]]]]]

2.5.9. Consider ways to prevent the introduction of debris such as: fall away, yard away.]]]]

2.5.10. Use streams as lateral boundaries for yarding roads, unless topographic and/or deflection conditions will ensure no disturbance of streamside vegetation and/or damage of instream habitat.]]]]]]]]]

2.5.11. The potential for cross-stream yarding is influenced by:

I) stream bank stability;
II) instream L.O.D.;
III) stream capability to transport debris.

a) If banks are unstable, the area has gullied terrain with deep soils, or L.O.D. is stabilizing the channel and logging may disturb or destabilize these conditions, then fall and yard away.]]]]]]]]] • •

b) If banks are stable and the channel is not dependent on L.O.D. for stability, then consider the potential for falling across and yarding over the channel subject to debris transport capability evaluation: • •

I) If the channel does not have the capability to transport debris, then cross stream falling and yarding may be undertaken without debris clean out.

II) If the channel has the capability to transport debris, then minimize debris entering the channel as debris clean-up will be required;

- Debris entry into watercourses can be minimized by such methods as directional falling or appropriate yarding systems.
- As an alternative to onsite debris cleanup, consider the use of a debris trap or grizzley. Debris traps may only be used where the channel is stabilized by bedrock or boulders and an accessible, stable site exists for trap installation and debris removal.
- The operation should be carried out with consideration to seasonal timing (see Appendix II).

2.5.12. Where stream clean-up of moving debris (see glossary) is recommended it must be carefully supervised. It is possible to destroy useful habitat through over-zealous clearance programs. Clean-up may have to be conducted in two phases:]]]]]]]]] • •

a) Immediately following or concurrently with logging.
b) Following the first freshet or series of freshets after logging.

STREAM REACH CLASS
I II III IV

2.6 Post-Operational;

2.6.1. In the event of slope instability or accelerated erosion in a cutblock after logging operations, stabilization measures should be taken to maintain forest site productivity and to minimize stream impacts. (See Appendix VIII)]]]]]]]]]]]]]]]]]]]]

2.6.2. If streambank erosion is occurring or has potential to occur, consider planting grasses, brush or tree species, or placing organic or inorganic armouring material to prevent streambank erosion or sedimentation.]]]]]]]]] • •

STREAM REACH CLASS
I II III IV

3.0 PLANNING AND OPERATIONS FOR SILVICULTURE:

3.1 Silvicultural Considerations in Harvesting Layout and Method:

3.1.1. Identify potential silviculture problem sites at the time of preharvest assessment and develop the most feasible plan to minimize problems with available engineering advice.]]]]]]]]] • •

3.1.2. Choose strategies and equipment to minimize ground disturbance where brush competition and erosion are problems. Excessive soil disturbance not only leads to erosion which may cause siltation in streams, it also promotes brush encroachment. Avoid exposure of mineral soils (e.g. by scarification).]]]]]]]]] • •

3.1.3. Where it has been determined that slashburning will be part of the post-harvest treatment, layout harvest boundaries to facilitate the protection of established streamside management zones.]]]]]]]]]]]]]]]]]]

3.1.4. Design block layout to facilitate possible use of aerial methods if fertilizer or herbicide application is expected (see Section 3.2).]]]]]]]]] • •

3.2 Brush and Streamside Deciduous Tree Control

(No part in 3.2 supercedes conditions of a Pesticide Use Permit.)

3.2.1. Assess the need for alder seed tree control during the pre-harvest planning stage. Treat streamside alder throughout all phases of logging and silviculture accordingly. This should be reviewed whenever possible during the Five Year Development Plan meeting.]]]]]]]]]

3.2.2. Where necessary, design a roadside brush control program to minimize the spread of brush into plantations.]]]]]]]]] • •

3.2.3. Avoid brush control on streamside and upland sites that are dependent on live root systems for stability.]]]]]]]]]]]]]]]]]]

3.2.4. Protect a streamside management zone or leave strip established during the harvesting phase when using either mechanical or herbicide brush control methods.]]]]]]]]]]]]]]]]]]

3.2.5. Maintain deciduous tree and brush species, in particular alder, where they are considered to be important for erosion control, stabilization of the streambank, cover or water temperature control. Consult with Fisheries Agencies and MOFL prior to the removal of streamside vegetation.]]]]]]]]] • •

3.2.6. A. Retain streamside alder seed trees unless sufficient streamside vegetation is present to adequately provide for stream productivity and the alder to be treated are not contributing to streambank and channel stability.]]]]]]]]]

B. Alder present on high-site flood plains adjacent to small, low energy tributaries and swamps may be removed, provided other deciduous vegetation or juvenile alder, less than 7 m, are present to provide streambank stability, adequate cover and biomass inputs.

	STREAM REACH CLASS I	II	III	IV
3.2.7. Where streamside alder removal has been approved by Fisheries Agencies and MOFL, consider mechanical removal, possibly during the harvesting phase. Cutting so as to leave high stumps and felling away from the stream are preferred to either girdling or herbicide applications because the former promotes coppicing and maintenance of the living roots. Consider other methods to promote coppicing.	]]]]]]]]	•	•	
3.2.8. Where approved to mechanically treat stands of mature or juvenile streamside deciduous trees in areas where they occur in uniform, extensive stands, carry out the treatment over a time phase sequence (See Glossary). Clean the stream channel of any debris resulting from deciduous tree control activities.	]]]]]]]]	•	•	
3.2.9. Herbicide use, including individual tree treatment, is generally not acceptable within 10 m of watercourses. For any herbicide applications considered within 10 m of watercourses, obtain approval from Fisheries Agencies or Pesticide Control Branch on a site specific basis. Ensure that the intended treatment is stipulated in the Pesticide Use Permit.	]]]]]]]]]]]]]]]]			
3.2.10. Identify and take measures as necessary to protect pesticide free zones as required by the Pesticide Use Permit. Ensure that small sidechannels and other waterbodies connected by streams, which are often obscured by brush cover, are located and protected.	]]]]]]]]	•	•	
3.2.11. Where practical, use ground based treatments rather than aerial treatments. The buffer zone for ground based applications will be much smaller than for aerial applications.	]]]]]]]]	•	•	
3.2.12. Conduct aerial applications with staff experienced in that method of application. Leave appropriate buffer zones and use ground application methods to ensure that the pesticide free zone is maintained along waterbodies. Take all precautions to minimize drift (See Pesticide Control Branch Aerial Spray Guidelines in Appendix VII.)	]]]]]]]]	•	•	
3.3. Site Preparation by Scarification:				
3.3.1. Scarify only those areas not included in the streamside management zones, fisheries sensitive zones, or leave strips established during the falling and yarding phase.	]]]]]]]]]]]]]]]]]]			
3.3.2. Scarify only those sites which are not susceptible to erosion or debris transport from flooding.	]]]]]]]]	•	•	
3.3.3. Avoid moving large organic debris which is associated with the stream channel and extends outside the streamside management zone or leave strip.	]]]]]]]]]]]]]]]]]]			
3.4. Site Preparation by Prescribed Fire:				
3.4.1. Burn only those areas not included in streamside management zones or leave strips established during the falling and yarding phase. Special measures may be required to protect no-treatment zones, e.g. sprinklers.	]]]]]]]]]]]]]]]]]]			
3.4.2. Avoid use of equipment to create fireguards adjacent to Class I waters where connecting sidechannels may be disturbed.	]]]]			

STREAM REACH CLASS
I II III IV

3.5. Fertilizer Application:

These guidelines apply to the application of pelletized urea only. Special measures may be required for the use of other fertilizers.

The guidelines are applied on a watershed basis rather than on a stream reach basis.

3.5.1. Plan for fall/early winter as primary application times.

3.5.2. In nutrient sensitive watersheds, the area approved for fertilization will be determined by the acceptable level of nitrogen loading to the stream.

3.5.3. Heliports should be located in dry areas, well removed from ditches or natural water bodies. Any drainage through heliports must be directed away from ditches or natural water bodies prior to use.

3.5.4. For those water bodies requiring a fertilizer free zone (FFZ), provide a 30 m FFZ in nutrient sensitive watersheds (see Glossary and Appendix IX) and a 10 m FFZ in non-sensitive watersheds.

3.5.5. Treatment boundaries are to be laid out so as to avoid inclusion of water bodies requiring a FFZ within the block. If this can not be accommodated, then lines should be flown parallel to the creek or water body to provide a buffer before applying fertilizer to the remainder of the block (see Appendix IX.)

3.5.6. Flight lines should be laid out so as to avoid deposition of fertilizer within defined fertilizer free zones. Flagging of the zone may be required on a channel which has open water but may not be observed as such at the time of application.

APPENDIX I: Interagency Agreement on Resource Management Conflict Resolution between Ministry of Forests and Lands, Ministry of Environment and Parks and Department of Fisheries and Oceans.

APPENDIX I

Interagency Agreement on Resource Management Conflict Resolutions

(1) It is agreed by the parties involved that the first level of interagency conflict resolution shall be at the Region or Area level.

(2) Problems which cannot be resolved at the Region or Area level shall specifically be referred by the senior region or area officers to their Headquarters' supervisor.

(3) The Headquarters' officers responsible for field operations of the 3 agencies shall jointly attempt resolution of the problem.

(4) If an issue cannot be resolved in Step 3 above, it shall be referred to the three signatories of this agreement.

(5) Prior to an attempt at resolution by the signatories, no independent, external action (including press releases) will be taken by one agency without advance notification to the other signatories.

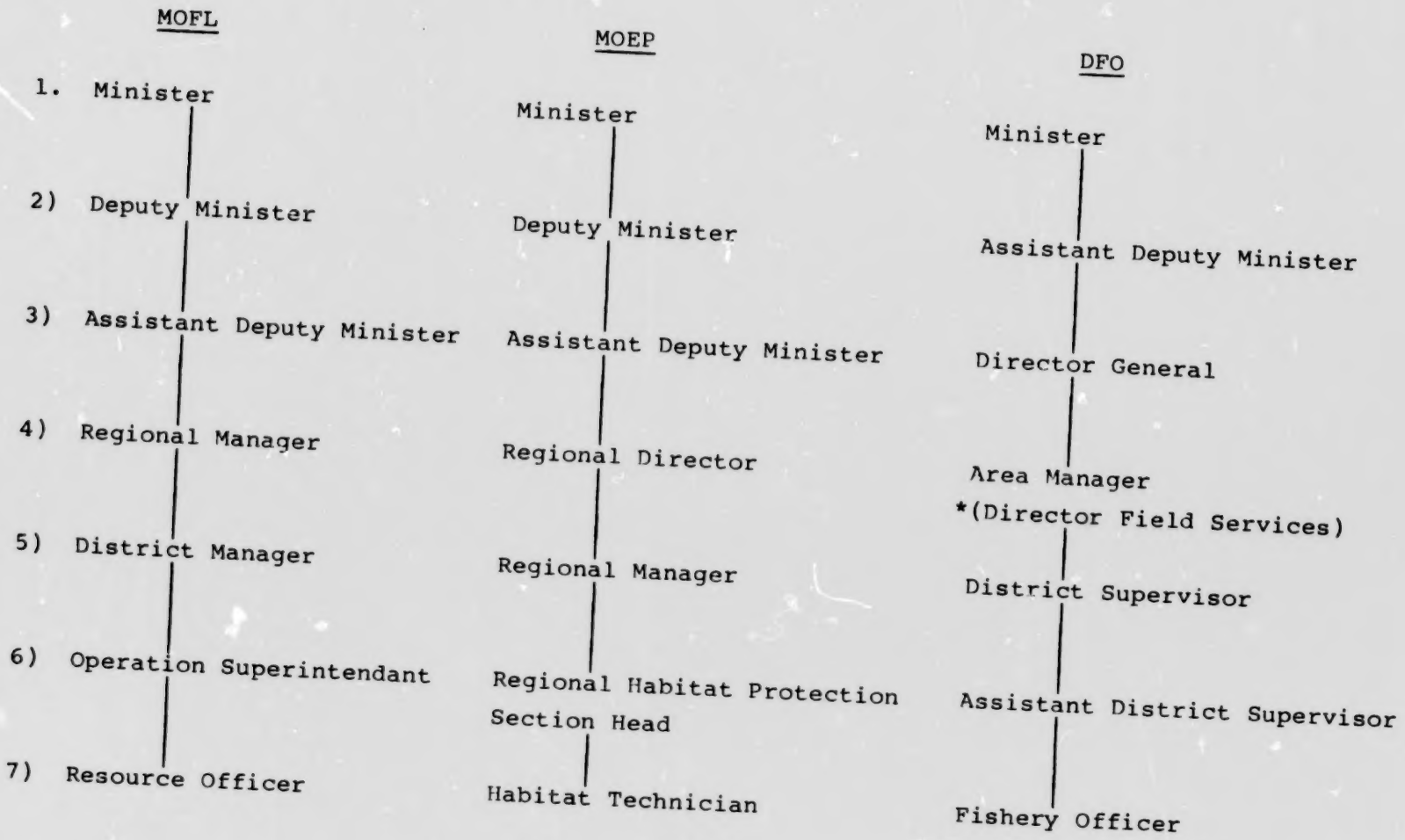
Signed: Dated:

H. D. Johnston, A.D.M., Pacific & Freshwater Fisheries — Jan 15/82

T. M. Apsey, Deputy Minister, Ministry of Forests — Oct. 19/81

B. E. Marr, Deputy Minister, Ministry of Environment — Sept 21/81

MOFL/MOEP/DFO PROTOCOL AGREEMENT: RESPECTIVE ACCOUNTABILITY LEVELS OF DECISION MAKING AUTHORITY

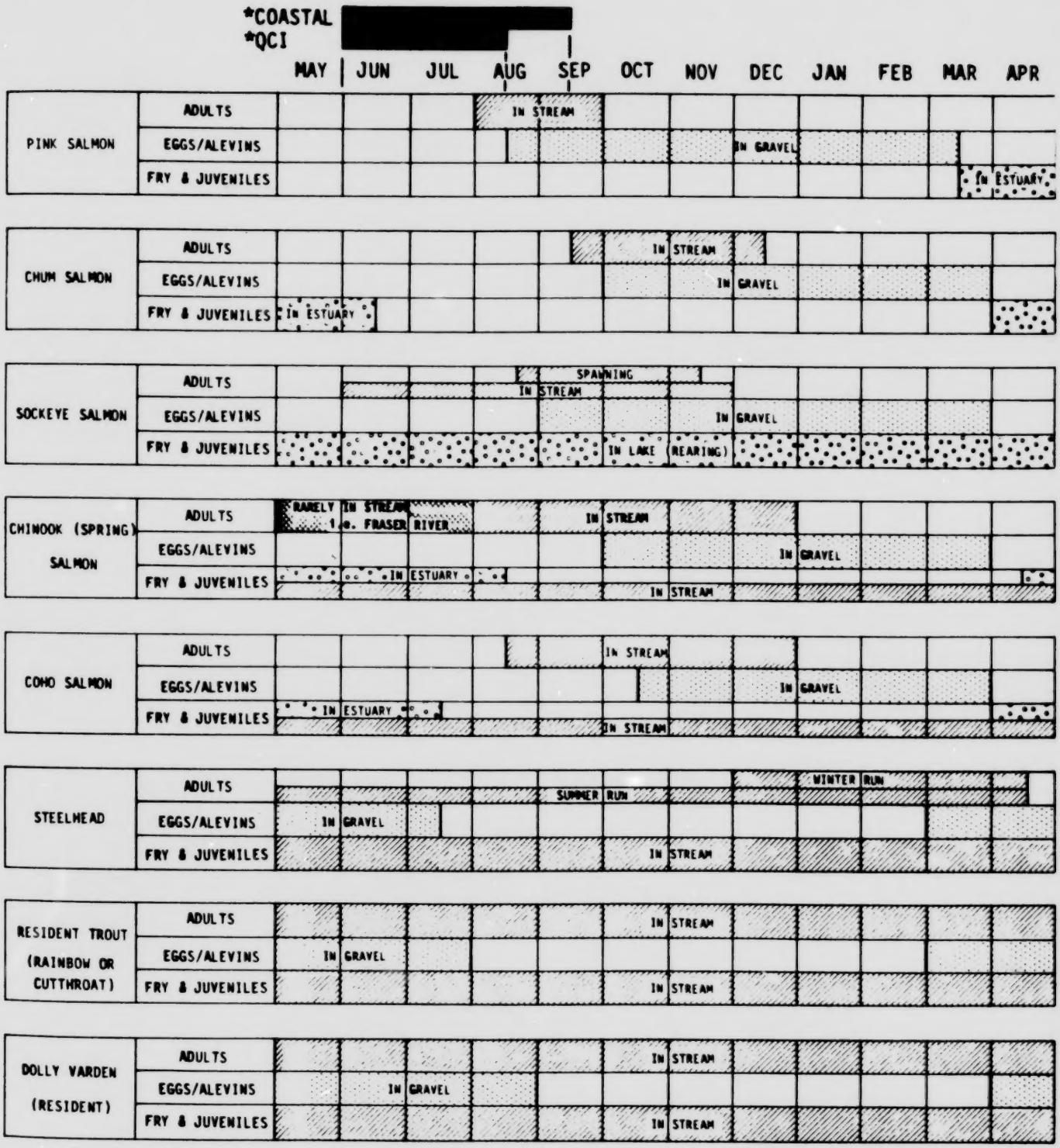


*Note: Possible internal referral to Director at this stage

APPENDIX II: General Freshwater and Estuary Residence and/or Utilization for Pacific Salmonids.

APPENDIX II

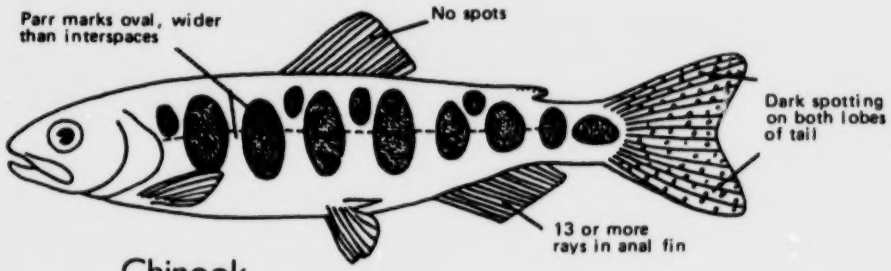
GENERAL FRESHWATER AND ESTUARY RESIDENCE AND/OR UTILIZATION FOR PACIFIC SALMONIDS



*PREFERRED "OPERATING WINDOW" FOR INSTREAM FOREST HARVESTING ACTIVITIES.

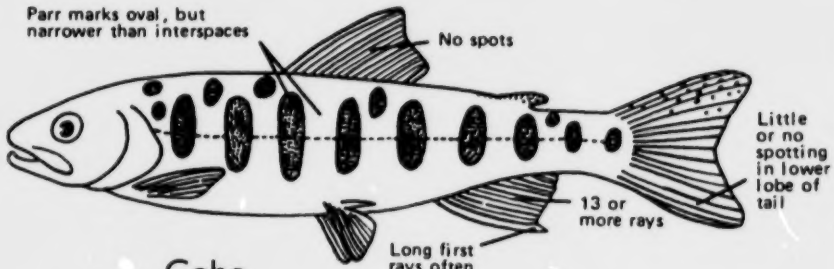
NOTE: CONSULTATION WITH LOCAL D.F.O. AND M.O.E. STAFF MAY AFFORD SITE SPECIFIC TIMING VARIATIONS FOR INSTREAM ACTIVITIES.

Identification features of juvenile salmonids

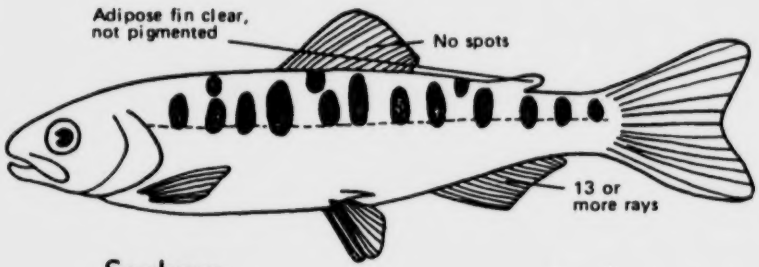


Chinook

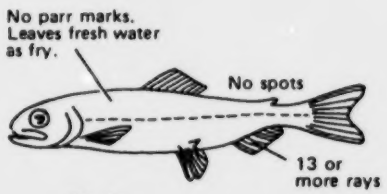
Chum


Parr marks oval, but narrower than interspaces
No spots
Little or no spotting in lower lobe of tail
13 or more rays
Long first rays often white

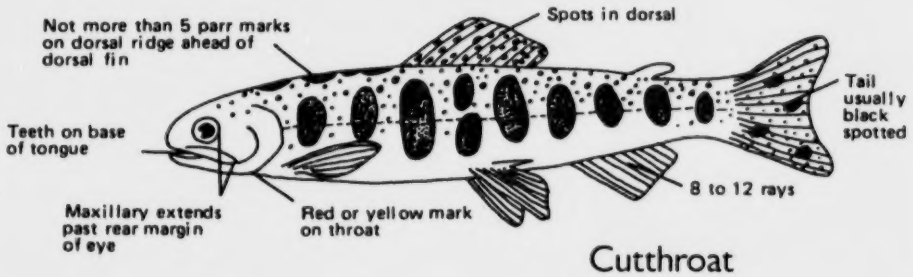
Coho



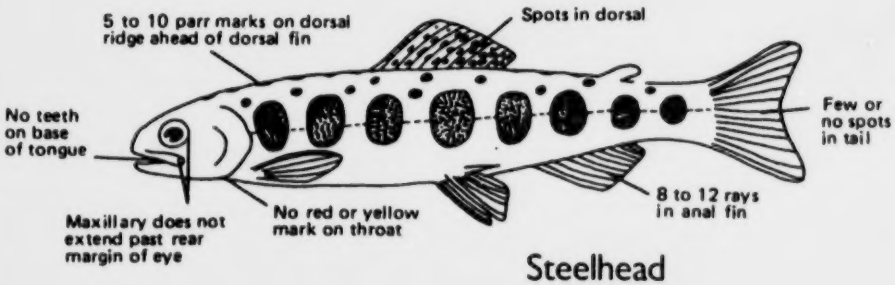
Sockeye



Pink


Not more than 5 parr marks on dorsal ridge ahead of dorsal fin
Spots in dorsal
Tail usually black spotted
Teeth on base of tongue
8 to 12 rays
Maxillary extends past rear margin of eye
Red or yellow mark on throat

Cutthroat


5 to 10 parr marks on dorsal ridge ahead of dorsal fin
Spots in dorsal
No teeth on base of tongue
Few or no spots in tail
8 to 12 rays in anal fin
Maxillary does not extend past rear margin of eye
No red or yellow mark on throat

Steelhead

APPENDIX III: Administrative Arrangements for Implementing Coastal Fisheries/Forestry Guidelines.

APPENDIX III

Administrative Arrangements for Implementing the Coastal Fisheries/Forestry Guidelines

Implementation of the Coastal Fisheries/Forestry Guidelines will be coast wide and the first phase will be for a two year trial period. A training program will precede the operational implementation on a phased basis.

The underlying assumption in the implementation is that the forest industry undertakes the initiative in protecting fish habitat as part of its overall responsibility for integrated resource management. Identifying stream reach classes will enable management effort and time to focus on developing prescriptions for priority stream reaches.

The general method for implementation is outlined below:

1. The guidelines will be used by the licencee in the preparation of the habitat component of the Five Year Development Plan. This component includes the identification of all stream reaches into the appropriate classes. The licencee will use data available from the government agencies as well as local knowledge. Preventative or remedial measures consistent with the guidelines, will be prescribed.
2. Unresolved issues will be the subject of consultation with the agencies, including on-site inspection if necessary.
3. Where necessary, site specific prescriptions can be included in the Cutting Permit document or boundary approval documents, whichever is customary in the Forest Region. It is expected that the guidelines themselves would not be appended to these documents, verbatim. More detailed prescriptions specific to the problem site and the individual circumstances, would be used.

1.0 INTRODUCTION

1.1 The implementation of the Coastal Fisheries/Forestry Guidelines is based on three major principles:

1.1.1 The principles, procedures and standards contained in Management and Working Plans apply.

1.1.2 The responsibility for initiating and drafting the plan for the protection of fisheries habitat as a component of a Five Year Development Plan rests with the licencee. The responsibility for final approval of a Five Year Development Plan, after review of the habitat component by the fisheries agencies, remains with the Ministry of Forests and Lands.

1.1.3 The classification of stream "reaches" and the incoporation of "reach" objectives form the basis for developing fisheries habitat prescriptions.

1.2 These guidelines apply to all public land forest tenures, i.e. Tree Farm Licences, Forest Licences, and including Timber Sale Licences, managed by the Ministry of Forests and Lands. In the case of Timber Sale Licences, the Ministry of Forests and Lands, rather than the licencee, is responsible for initiating and referring all forest harvesting plans.

2.0 REFERRAL SYSTEMS

2.1 The referral process presently in place throughout the coastal area will continue and can be adjusted or modified where regional variations dictate or, when agency and forest industry personnel seek better ways.

2.2 Where new policies such as the TFL Subsidiary Agreement are approved, new referral procedures can be implemented as required.

3.0 FIVE YEAR DEVELOPMENT PLANS

3.1 Preparation of the fisheries habitat component of the Five Year Development Plan requires that:

3.1.1 All streams in the area proposed for logging should be mapped and classified to the extent information is available. At a minimum all segments of the area proposed for logging which contain Class I or II stream reaches must be identified on maps. (See Section 5.2)

3.1.2 Where it is proposed to apply forest harvesting treatments to a particular stream reach, and those treatments do not conform with the guidelines established for that reach class, a statement of justification must be provided.

3.1.3 All pertinent resource values must be addressed in the preparation of an acceptable Five Year Development Plan. These guidelines are not intended to infer that other resource values such as wildlife, aesthetics, recreation, forests, etc. are less important than fisheries.

3.2 The licencee has a responsibility to initiate liaison with the B.C. Ministry of Environment and Parks, B.C. Ministry of Forests and Lands, and the Canada Department of Fisheries and Oceans during the preparation of the Five Year Development Plan.

3.3 The Five Year Development Plan will be referred to appropriate government agencies for review and comment prior to approval by the District Manager of the Ministry of Forests and Lands. Every effort will be made to process Five Year Development Plan referrals as quickly as possible.

3.4 The responsibility for final approval of the Five Year Development Plan remains with the Ministry of Forests and Lands.

3.5 The Licencee is responsible to ensure the plan is implemented as approved.

4.0 SILVICULTURAL PLANS AND OTHER PLANS (i.e. road maintenance plans)

4.1 If requested by environmental agencies, silvicultural plans and other plans will be referred, in accordance with the procedure in Section 2.0 above.

5.0 CUTTING PERMIT APPLICATIONS

5.1 Cutting Permit and final boundary applications will be submitted to the District Manager of the Ministry of Forests and Lands and will state the permit is in agreement with the Five Year Development Plan.

5.2 All streams in the area proposed for logging must be mapped into their pertinent reach classes.

5.3 The District Manager will not approve any Cutting Permit not consistent with the approved Five Year Development Plan, without consulting with the fisheries agencies.

5.4 The Cutting Permit or subsequent boundary approval may include site-specific environmental prescriptions if the agencies believe a sensitive situation justifies the inclusion.

6.0 APPEAL PROCESS

6.1 The licencee retains the option to appeal any decision to a higher level in any of the government agencies.

6.2 The resolution of resource conflicts between the three government agencies will be achieved by elevating the issue to the next hierarchial level as outlined in the existing signed agreement between the Ministry of Forests and Lands, Ministry of Environment and Parks and Canada Department of Fisheries and Oceans (see Appendix I).

7.0 CONTINGENCIES AND LEGAL ACTION

7.1 All parties recognize there will be occasions when natural disaster, unforeseen circumstances or incorrect information renders the approved Five Year Development Plan inadequate or inappropriate. In such cases, the licencee must contact the pertinent agencies or vice versa and arrange to jointly address the problem and amend the plan, as required.

7.2 Where approved management prescriptions and/or contract conditions are not followed, penalties provided in the legislation of the government agencies remains applicable. Nothing in these guidelines waives the application of existing environmental legislation and subsequent legal action, where abuse or omissions occur.

8.0 PUBLIC INVOLVEMENT

8.1 The Ministry of Forests and Lands public involvement policies with respect to TFL Management and Working Plans, and Five Year Development Plans, such as public viewing opportunities, etc., remain applicable.

8.2 In addition, the public involvement policies of the B.C. Ministry of Environment and Parks and the Canada Department of Fisheries and Oceans will continue to be implemented, as appropriate.

Appendix IV

Rationale for Stream Reach Classification for the Guidance of Forest Practices in Coastal British Columbia

CONTENTS

1.0 INTRODUCTION

2.0 DEFINITIONS AND PRINCIPLES

3.0 STREAM CLASSIFICATION CRITERIA AND RECOMMENDATIONS
- 3.1 General Criteria
- 3.2 Specific Criteria
  - 3.2.1 Fish Species Presence
  - 3.2.2 Stream Gradient and Width
- 3.3 British Columbia Stream Reach Classification and Management Objectives
  - 3.3.1 Class I Stream Reaches
  - 3.3.2 Class II Stream Reaches
  - 3.3.3 Class III Stream Reaches
  - 3.3.4 Class IV Stream Reaches

4.0 HABITAT INVENTORY IMPLICATIONS

1.0 INTRODUCTION

The principal objective of the Carnation Creek Follow-up Technical Workshop of April 19-21, 1983, was the revision of existing Coastal Fisheries/Forestry Guidelines. To assist in this task, a committee was appointed to review existing stream classification systems, to recommend a system appropriate for inclusion in the new guidelines and to prepare an associated glossary of terms. The committee was also asked to address issues of stream inventory standards which might be relevant to the classification process.

Information for this task has been assembled from the literature, from discussions at forest harvesting and habitat evaluation workshops and with professional colleagues who deal with fisheries/forestry guidelines. Advice from the Washington State forestry and fishery management agencies has been particularly useful.

The objective of this stream classification procedure is to enable alternate sets of guidelines to be applied to stream reaches with substantially different properties. The acceptance of these stream classes by resource managers assumes the support of the following policy and principles:

1. That fish habitat and stock management objectives differ for the various stream classes, and in particular that some habitats and some populations are of less value than others. These management objectives are detailed in section 3.3.

2. That the basis for classification is the capacity of the stream reach to produce fish.

3. That the divided jurisdiction in responsibility for management of resident and anadromous fish will not affect the classification of stream habitats.

The practicalities of implementing a stream classification system which will be used in the harvesting planning process suggest that data requirements must be simple, well defined and standardized. The stream classification system will, therefore, be evaluated as part of the trial phase of the Fisheries/Forestry Guidelines implementation process to determine how readily data requirements can be met and the effectiveness of the classification system.

2.0 DEFINITIONS AND PRINCIPLES

1. Although we generally speak of streams as whole entities (e.g. the Fraser River), it is clear that the lower reaches (e.g. near Vancouver) have very different properties than upper reaches (e.g. near McBride). Stream classification is thus a classification of stream reaches.

For the purpose of stream classification fairly extensive reaches can be defined, changing only when required by the classification criteria. It must be emphasized that although upstream reaches may be designated at a lower class, their influence on downstream reaches must be considered. This is particularly important in considering the movement of sediment and debris.

2. It is also necessary to distinguish between what is or is not a stream, both for jurisdictional (i.e. institutional) purposes and for ecological clarity. A stream exists when water flows between defineable continuous channel boundaries. These boundaries constitute the streambed and banks which are formed by, and are evidence of, fluvial processes. The stream channel exists whether or not it contains water throughout the year and no matter how small it is. It should be noted that small hillside gullies, although not falling within the definition of a stream, have the ability to trap sediment and debris and release them into the stream.

Many aquatic environments are not properly classified as streams, but may be important or even critical for fishery production. These fishery sensitive zones include estuaries, sloughs, ponds and backchannels of the floodplain, the valley wall ponds fed by upslope seepage, and the seasonally filled depressions providing fish access to and from main channels at higher flows.

3. It is also important to note that although a stream classification has been recommended, that classification is applied to sets of guidelines for activities (e.g. falling and yarding, road building) on land surrounding the streams. The guidelines will always require some fine-tuning to match the characteristics of the land and the influence of those land based activities on the stream environment. Hence, for the application of the guidelines, information about soils, vegetation, windfirmness, climate, and especially terrain, will also be necessary.

4. A very large number of interacting biological and physical processes determine the type of stream present, its capacity to produce fish and its inherent stability. A quantitative assessment of these factors on every site would demand resources which are not available to management agencies at this time. Hence, certain critical factors are usually chosen which provide useful indexes to those processes. Review of existing classification systems (see next section) suggests that the following three are useful for most management objectives.

a. The presence of certain fish species groups
b. The gradient of the stream channel
c. The size of the stream channel, usually indicated by its width.

5. A stream is a downstream continuum. Upstream reaches are most dependent on terrestrial processes for water, nutrient and energy inputs. Downstream reaches are influenced by the products of upstream reaches, as well as by adjacent terrestrial environments.

6. There is a far greater total length of steep, narrow stream habitats than those which are broad or of low gradient. This means that the most commonly experienced management problem or goal will be the prevention of accumulating downstream impacts by maintaining the stability of existing channel networks.

7. Even with the best stream typing information, the classification can only be applied with common sense. Not only do habitat preferences of fish species vary widely, but management policies and exploitation rates may vary the sensitivity of a stream to disturbance. The increasing emphasis being placed on salmonid enhancement (e.g. headwater stocking) in the B.C. coastal region make this particularly important.

8. It is implicit in the following section that water temperature is not a common problem in coastal British Columbia. Exceptions do occur, in which case standard stream temperature management procedures may be necessary to maintain water quality.

3.0 STREAM CLASSIFICATION CRITERIA AND RECOMMENDATIONS

Stream classification systems which are applicable to fisheries/forestry guidelines have been assembled from Washington, Oregon, Montana, Yukon and various British Columbia applications.

3.1 GENERAL CRITERIA

The information reviewed and discussions with resource managers suggest some necessary criteria for classification systems used in guideline processes:

1. They must be clear and understandable to both resource managers and to non-technical interest groups (e.g. loggers, sport fisherman).
2. They must identify both in-stream values and the stream features which activities such as forest harvesting might affect.
3. They must be grouped in classes or ranges of values so that planning and priorization of effort is possible.
4. The classes and associated guidelines must avoid a "cookbook" rigidity, but must provide sufficient management direction and flexibility to allow an experienced manager to reconcile forest harvesting system limitations with stream system requirements.
5. They must be based on data which are usually available or easy to obtain. This criterion is a mandatory prerequisite for the successful implementation of any classification system.
6. Classes must apply to definable stream reaches rather than whole streams.

3.2 SPECIFIC CRITERIA

Three specific criteria recurred in most classifications reviewed: fish species presence, stream gradient and stream width. Although these factors can be used to define a stream class, and hence the management objectives associated with that class, the choice of the most appropriate means to meet those

objectives usually requires some additional information. Soil and slope stability, channel and bank stability, forest type and windfirmness, fishery sensitive zones and the relationship between upstream and downstream reaches will all influence the specific harvesting plan. The influence of these factors on the capability of a stream to transport debris and sediment downstream is of particular importance. These factors have been considered in the development of the Coastal Fisheries/Forestry Guidelines.

3.2.1 FISH SPECIES PRESENCE

All the classifications reviewed used fish species presence as an indicator of stream "value". Correlated habitat parameters such as gradient and width are only used in the absence of good fish data, and are then used to indicate habitat capability (Figure 2). Due to the general lack of detailed fish population data, habitat inferences are frequently necessary in British Columbia. They must be used with caution, however, because of the wide variability in geographic and ecological properties.

Relative abundance or population numbers are difficult to apply on the ground, not only because of lack of data, but also because of a lack of agreement on terms such as "substantial" or "significant". Jurisdictional differences play a role (see Introduction), as well as varying management emphases such as large vs. small river management and hatchery vs. natural/semi-natural production.

The number of species class groupings chosen reflects both jurisdictional concerns and data availability. The major classes distinguished were anadromous, resident sport, non-sport and no fish. It is considered that these distinctions are valid, with provision for upgrading where approved management plans exist. Specific cases where upstream non-sport populations may contribute to downstream managed stocks may require careful evaluation.

3.2.2 STREAM GRADIENT AND WIDTH

Gradient was also commonly referred to as an indicator of stream capability. Although much variability exists between species, it is well documented that fisheries productivity (diversity and density) is higher in lower gradient stream reaches. Some species (e.g. cutthroat trout) have been found in reaches up to 17% average gradient, but were localized in pockets of lower gradient water within the reach (i.e. pools below falls). Figure 1 illustrates the general gradient vs. species trend.

Low gradient streams tend to be located in valley bottoms which also contain the highest value timber sites. Hence, the highest degree of on site habitat protection measures often will be required in areas of highest forest resource values.

High gradient streams, although of relatively lower value for spawning or rearing, have a correspondingly higher capability to transport sediment and debris downstream. The management objective for these streams is to protect downstream anadromous and resident sport fish reaches from accelerated transport of debris or sediment.

While not specific to stream classification it is important to note that in many low to moderate gradient streams, stable in-channel debris holds gravel, provides habitat cover and diversity, dissipates energy and contributes significantly to habitat complexity and fish production. Streams devoid of large stable debris have lower habitat complexity and are less productive.

3.3 BRITISH COLUMBIA STREAM REACH CLASSIFICATION AND MANAGEMENT OBJECTIVES

After reviewing existing classification systems and the stream characteristics previously noted, a four class system has been adopted, based primarily on the presence of fish species groups and secondarily on stream gradient. Gradient and related properties must be included as they are well correlated with fish species, hydrologic and hydraulic properties and sediment and debris transport capability. As was mentioned above, it is necessary to couple the stream class with other land or watershed characteristics (e.g. soil erodibility and terrain) to determine which protection measures are required for the class selected.

In the absence of fish species data, the gradient classes of 0-8, 8-12, 8-20 and greater than 20% are used as class indicators.

The use of this classification system is predicated on a set of objectives associated with each stream class which provide criteria for choosing specific guidelines and a basis for evaluation of performance.

3.3.1 CLASS I STREAM REACHES

Anadromous salmonids or moderate to high levels of resident sport fish are present,[1] or the reach has been identified for upgrading in an approved fisheries management plan. Stream gradient is usually less than 8%.

Objective: Maintain productive capacity of fish habitats. This specifically requires measures which will

1. Maintain water quality.

---

[1] Fish presence may be for only one life history phase (e.g. spawning, overwintering).

2. Maintain the integrity of stream channels and banks.
3. Maintain the quality of streambed gravels.
4. Maintain the adjacent source of fish food producing material and organisms for the stream.

To meet the objective for Class I streams, it may be necessary to design compensating or mitigating measures which offset the unavoidable effects which even careful forest harvesting may have on a stream system.

3.3.2 CLASS II STREAM REACHES

Low levels of resident sport fish are present. Stream gradient is usually 8-12%.

Objectives: Minimize loss of productive capacity of fish habitats and maintain sufficient stream channel integrity to protect Class I reaches from accelerated transport of sediment or debris.

3.3.3 CLASS III STREAM REACHES

Resident non-sport fish are present. Stream gradient is usually 8-20%.

Objectives: Maintain the genetic stock of indigenous species. Some permanent reduction in stock size or in-stream habitat may occur providing that necessary life processes are maintained and sufficient stream channel integrity is maintained to protect Class I and Class II reaches which may be impacted from accelerated transport of sediment of debris.

3.3.4 CLASS IV STREAM REACHES

No fish are present. Stream gradient is usually greater than 20%.

Objective: Maintain sufficient stream channel integrity to protect Class I and Class II reaches, which may be impacted from accelerated transport of sediment or debris.

4.0 HABITAT INVENTORY IMPLICATIONS

Stream habitat information sufficient to enable the application of this classification requires, at a minimum, the determination of fish species presence, stream gradient and management objectives for each reach of stream being classified. This information is, or will be, generally available from fisheries agencies.

If any group is planning for additional or new inventory, they are strongly recommended to contact designated representatives of the Federal/Provincial Habitat Inventory and Information Program to ensure that existing information has not been overlooked, and that compatible methods are used.

Field inspections to verify stream classes, if required, offer an opportunity to supplement the elementary data mentioned with additional population or habitat information. This additional information may identify opportunities to make considerable refinement to harvesting guidelines, and potentially to increase or maintain fish production while maintaining or lowering forest harvesting costs. Close cooperation between all resource specialists is encouraged.

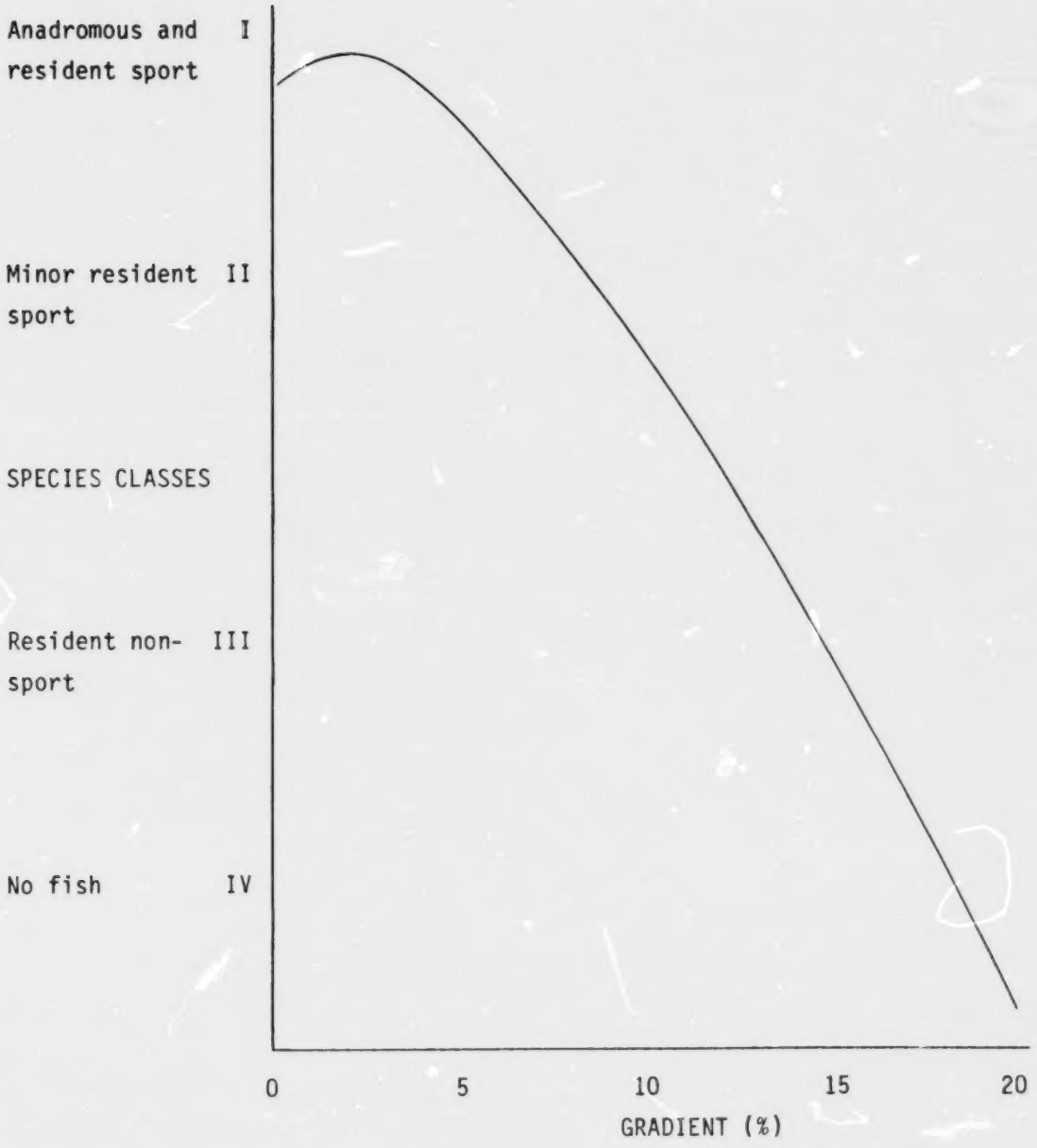
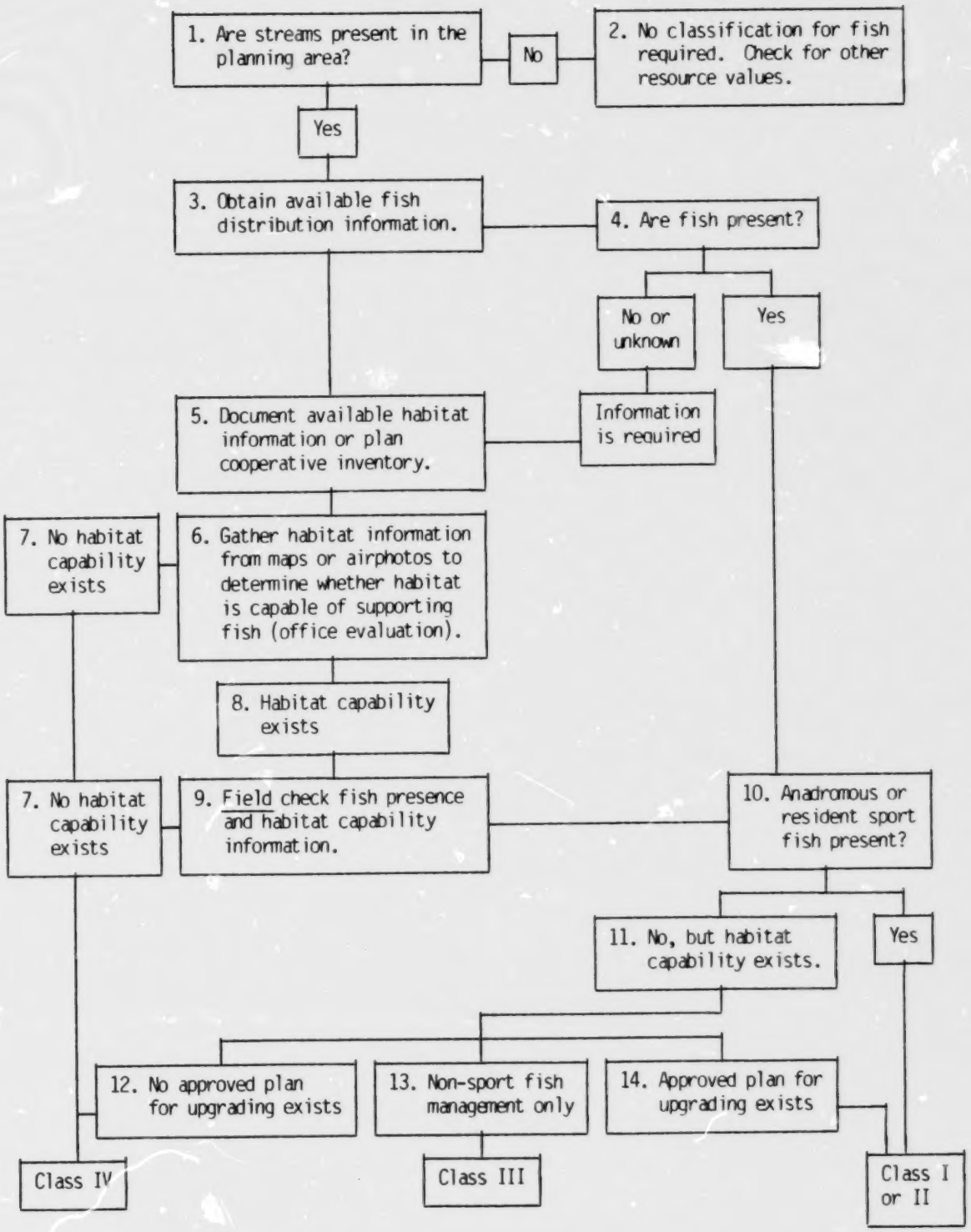


Figure 1 ... Generalized relationship between species classes and stream gradient Regional and species specific differences may apply.

Figure 2

STEPS FOR STREAM REACH CLASSIFICATION


1. Are streams present in the planning area?
No
2. No classification for fish required. Check for other resource values.
Yes
3. Obtain available fish distribution information.
4. Are fish present?
No or unknown
Yes
Information is required
5. Document available habitat information or plan cooperative inventory.
7. No habitat capability exists
6. Gather habitat information from maps or airphotos to determine whether habitat is capable of supporting fish (office evaluation).
8. Habitat capability exists
7. No habitat capability exists
9. Field check fish presence and habitat capability information.
10. Anadromous or resident sport fish present?
11. No, but habitat capability exists.
Yes
12. No approved plan for upgrading exists
13. Non-sport fish management only
14. Approved plan for upgrading exists
Class IV
Class III
Class I or II

APPENDIX V: Engineering Specifications for the Planning, Design, Location, Construction and Maintenance of Logging Roads and Drainage Structures.

MINISTRY OF FORESTS AND LANDS
MAR - 5 1987

File: _____

Date: _____

Roadway Width _____

APPENDIX V

BRITISH COLUMBIA FOREST SERVICE

ENGINEERING SPECIFICATIONS FOR THE PLANNING, DESIGN, LOCATION CONSTRUCTION, AND MAINTENANCE OF LOGGING ROADS AND DRAINAGE STRUCTURES IN THE VANCOUVER FOREST REGION

A. Engineering Policy

A1. With due consideration for the appearance of forest landscapes in visually sensitive areas and for the protection of water quality, fisheries, and other resource values, the location and design (alignments and gradients) of all logging roads and bridges shall be such that the combined costs of construction, maintenance, and log hauling are minimized. Competent personnel shall be employed for the design and location of roads (and logging layout) and firm supervision and control given all construction work.

When the construction is finished, the road surface shall be maintained for economical hauling, ditches and culverts for efficient drainge and bridges for safe carrying capacity. Brush shall be removed from the right-of-way as required for good visibility.

A2. Road construction is recognized as a major cause of stream sedimentation. Accordingly, the amount of road built shall be minimized (in conjunction with logging layout) particularly where unstable or sensitive areas and fine textured soils have been identified. Road construction shall be avoided through areas having a high potential for sedimentation or slope instability, wherever other resources are threatened.

Where possible, environmental impacts will be minimized by:

1. locating roads away from streams, narrow canyons, slide areas and marshes;
2. locating roads on benches, ridge tops, and flatter slopes;
3. taking precautions to ensure that non-culverted drainage channels are clear and the risk of subgrade erosion is minimized whenever unfinished road is to be left over the winter;
4. prescribing for each roads those design specifications that are best adapted to given slopes, topography, and soils.

A3. The following specifications may be modified or amended only with the approval of the Forest Officer. Construction prescription, e.g. and hauling, may be added to meet unusual or special conditions.

B. Minimum Road Specifications

B1. Turnouts: Five turnouts, preferably intervisible, with a useable length of about 30 metres and a total width including road of 8 metres should be built per kilometre of single lane road. For temporary roads, construct turnouts as required and where the least environmental damage will occur.

B2. Widenings: Widen all curves to allow for side tracking of truck-trailer units. On blind curves, the road should be at least 8 metres wide around the curve and for 100 metres approaching each end of the curve.

B3. Right-of-Way Clearing, Grubbing, and Slash Disposal:

1. Fell all trees within a right-of-way area 3 metres beyond the top of cuts and 3 metres beyond the toe of fills.
   Fell leaners and damaged trees which are adjacent to the right-of-way and yard into the right-of-way any trees felled into standing timber.
2. Recover merchantable logs.
3. Remove stumps and organic soil to a maximum width of 12 metres on level ground and easy slopes except where construction by over-landing is being done. Go to widths more than 12 metres as dictated by sideslopes and centreline cuts.
4. Dispose of road clearing slash and non-merchantable wood by piling and burning or by burying either in the toe of the fill, or in pushouts adjacent to the right-of-way as directed by the Forest Officer.

B4. Ballasting and Surfacing: Place sufficient ballast or surfacing material to carry loaded (design load) logging trucks without rutting or deforming the road surface. Give due consideration to the planned traffic frequency, quality of ballast and surfacing materials, and required maintenance.

C. Pits and Quarries

Obtain approval of the Forest Officer for pits or quarries that will extend beyond the right-of-way boundaries. Clear the area and dispose of slash as per B3, section 1, 2, and 4. Dress the pit slopes to a natural angle of repose before it is abandoned if deemed necessary by the Forest Officer.

D. Bridges

D1. Locate, design and construct bridges which will:

1. Carry the design load according to accepted Engineering principles.
2. Pass the 100 years flood when materials are glulam, concrete or steel or for log bridges specified by the Forest Officer.
3. Pass the 50 years flood for log bridges over major tributaries.
4. For all other tributaries pass the 25 years flood.
5. Satisfy site specific constraints to limit scour, siltation, erosion and environmental damage.
6. Satisfy timing constraints for construction.

E. Culverts

E1. Design all culverts according to accepted Engineering principles to carry the design load and pass the specified peak flood. Install metal culverts according to manufacturer's recommendations.

E2. Select metal pipe or cedar log culverts with enough capacity to pass the 50 years flood on main roads and the 25 years flood on the other roads at HW?D=1.0. Place pipe culverts at a slope coincident with the stream slope whenever practical.

E3. Install enough culverts to ensure the natural drainage pattern of all streams both seasonal and continuous. Install additional culverts as necessary to drain ditches and minimize ditch erosion. Provide temporary culverts during the pioneering stage where siltation or erosion is a problem. Keep stream channel free of construction debris.

E4. Space crossdrain culverts no more than 150 metres apart on grades over 10% and 230 metres on grades less than 10%.

E5. Do not install metal culverts smaller than 500 millimetres in diameter or wood culverts with an opening smaller than 500 millimetres by 1,000 millimetres.

E6. Select sound cedar for wood culverts. As a general rule, place sill logs outside the average high water mark of the stream unless otherwise designed as per E1.

E7. Provide adequate drainage at all road junctions.

E8. Adopt, as part of the regular maintenance program the inspection and maintenance of ditches and culverts.

E9. Inspect, and if necessary, clean out and repair all ditches and culverts before the normal runoff season and immediately following peak or exceptionally heavy rainfalls.

F. Special Provisions for Maintenance of Water Quality

F1. Install aprons or flumes to carry water from culverts over unstable fills or preferably, replace the unstable fill at the culvert with a non-erodible material (e.g. rip-rap) to absorb the impact of discharge. Protect culvert inlets from erosion as required.

F2. Maintain the natural course of all stream whether seasonal or continuous.

F3. Install crossdrain culverts to divert ditch water away from seasonal and continuous streams, or direct the water into sediment catchment basins away from the streams.

F4. Construct cut and fill slopes to suit the local soil and rock material. See Form F.S.650 for some recommended slopes.

F5. Adopt measures to stabilize cutbanks and fillslopes when soils are unstable, e.g. grass seeding.

F6. Plan borrow pits and waste areas to minimize erosion and water turbidity.

F7. Do not dump or spill material or debris in any stream or lake. Keep culvert and bridge site clean during and after construction.

F8. Suspend any road building operation causing erosion or siltation especially during periods of intensive rainfall or heavy runoff or when soils are saturated.

F9. For shovel constructed subgrade on easy slopes, increase the cleared width to provide for spreading of unuseable material. Such material should be spread no more than 1 metre deep and must be suitably protected to prevent erosion, (e.g. grass seeding).

F10. When forest operations on temporary roads are finished, (or annually if necessary) remove all culverts and temporary bridges and construct water bars.

F11. Use backhoes to build road on erodible or poorly drained soils.

F12. Maintain the road to prevent accelerated erosion and water quality degradation. Crown roads to prevent the accumulation of surface water.

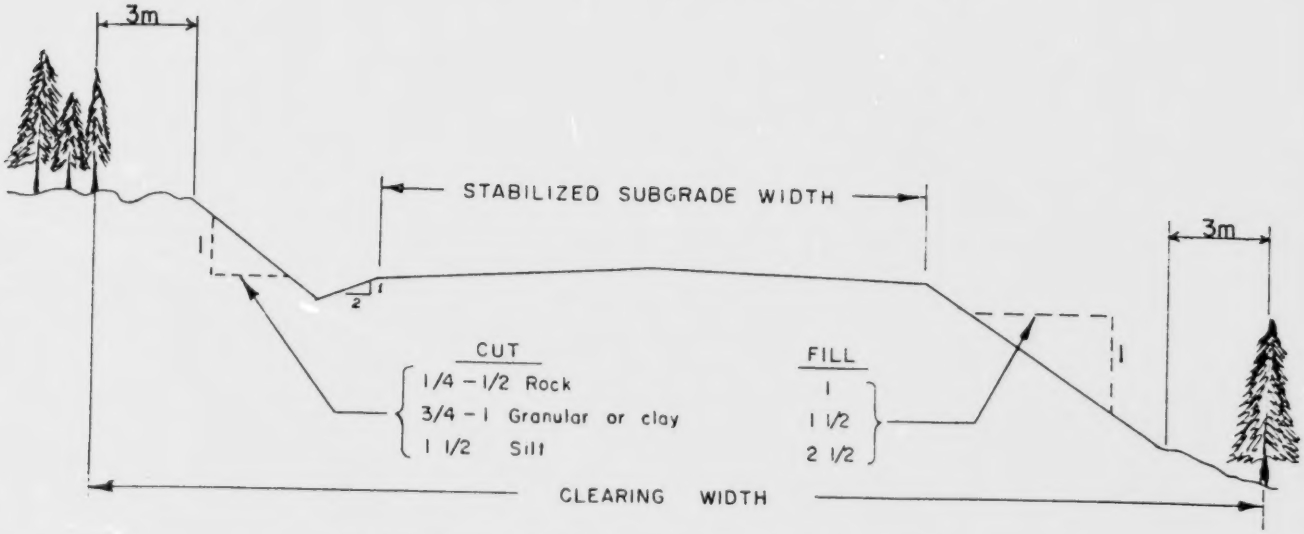
G. Special Provisions for Protection of Fish Bearing Streams

G1. Obtain the approval of the Forest Officer for the design, and the time and method of construction of all structures proposed over fish bearing streams.

G2. Protect the shorelines of streams and lakes and shoreline shrubs from damage due to right-of-way clearing, logging, and burning as specified by the Forest Officer.

G3. Observe all constraints listed above, particularly in D, E, and F.

Roadway Cross-section



STANDARD DIMENSIONS IN METRES

ROAD CLASS	STABILIZED SUBGRADE WIDTH	DITCH DEPTH	CLEARING WIDTH
CLASS 1	10	1.0	35
CLASS 2	9	1.0	30
CLASS 3	8	1.0	30
CLASS 4	6	0.7	25
CLASS 5	5	0.5	20
CLASS 6	4	0.3	20

Local variations in the standard road dimensions are frequently required because of the following circumstances:

a) Clearing width - may be increased or decreased to suit local conditions or particular requirements.

b) Subgrade width - may be increased for turnouts and widenings or decreased in rock cuts.

c) Ditch depth - may be increased to facilitate adequate ditch gradients, or for drainage of unusually wet soil. Depth may be decreased in rock or hardpan sections. In flat country, scraper ditches approximately 4 m wide may be constructed to obtain material for raising the subgrade above the general ground level.

File_____

Date_____

District_____

Tenure_____

BRITISH COLUMBIA FOREST SERVICE

MINIMUM ROAD SPECIFICATIONS FOR CONSTRUCTED ROADS

For maintenance of road servicing _____

A. Maintain the road surface for logging trucks in all weather for the full duration of the use of the road, by grading the surface, strengthening the surface with gravel, removing obstructions such as sloughs and windfalls, snow ploughing and sanding (if applicable).

B. Prevent water damage to the road by maintaining a proper camber on the surface, cleaning ditches and drainage structures, repairing or replacing defective or inadequate drainage structures, installing new drainage structures where necessary. All new culverts shall be designed to handle maximum flow, and shall be galvanized metal pipe. Minimum diameter of such culverts is to be 45 cm.

C. Maintain the appearance of the right-of-way by bucking and burning or burying all wood debris resulting from maintenance work.

D. Prevent pollution to adjacent lakes, rivers, and streams (whether continuous or seasonal) by preventing soil and debris from entering their waters. Where it is absolutely necessary to fill so close to the above mentioned waters that the toe of the fill may be washed by high waters, the toe of the fill shall be formed of clean rip-rap. Under no circumstances shall the normal flow channels be obstructed.

E. The construction of branch road junctions with this road shall comply with the following:

    a. A 45 cm diameter metal culvert with a minimum of 30 cm of gravel covering it shall be placed at the junction.

    b. Approach to the junction shall be as level as possible and as close to a right angle (90 degrees) as possible.

    c. Sight distance at the junction is to be 75 m.

F. Erosion due to maintenance work is to be limited by working in the drier seasons of the year.

Province of British Columbia

Ministry of Forests

FOREST SERVICE

File .....

Date .....

District .....

T.S. .....

MINIMUM ROAD SPECIFICATION

For Survey and Construction of .....

1. Road dimension .....

2. Grades:

Favourable—

Sustained favourable grade not to exceed ..... per cent

Maximum allowable grade in pitches not longer than ..... m is ..... per cent

Adverse—

Sustained adverse grade not to exceed ..... per cent

Maximum allowable on momentum grade not longer than ..... m is ..... per cent

Switchbacks—Grade not to exceed ..... per cent

3. Alignment:

Average design speed, ... km/h

Minimum radius of curves, ... m in control section.

Minimum radius of switchback curves, ... m

4. Turnouts:

Usable length to be not less than ..... m

To be intervisible.

There shall be not less than ..... turnouts per kilometre

Total road width of turnout to be ..... m

5. Widenings:

All curves to be widened to allow for side tracking of truck-trailer units, including low-beds.

On blind curves minimum width to be ..... m

6. Drainage Structures:

Bridges to carry ..... tonnes safely

Type of bridge construction .....

Permanent/temporary culverts to be placed as required.

Cross drains to be placed not over ..... m apart

on grades over ..... per cent,

otherwise ..... m apart.

January 1978
P.S. 648—1M-578-320

(OVER)

7. Right-of-way Clearing:

All trees and brush to be cut down within ..... m of the top of cuts and within .....m of the toe of fill.

Slash disposal (e.g., burning, burying, grubbing, etc.) to be:

8. Surfacing:

9. Special Provisions:

APPENDIX VI: ADMINISTRATION AND ISSUANCE OF PERMITS PURSUANT TO THE B.C. GRAVEL REMOVAL ORDER

Department of Fisheries and Oceans

APPENDIX VI

Administration and Issuance of Permits Pursuant to the British Columbia Gravel Removal Order

Under the Fisheries Act (Canada), a permit in writing issued by the Regional Director (of Federal Fisheries) or a Fishery Officer is required to remove or displace gravel from the watercourses described in the B.C. Gravel Removal Order (Attachment 1). Procedures for the administration and issuance of permits pursuant to this Order are as follows:

A. Signing Authority

Permits to remove or displace gravel under the Order may be issued by Fishery Officers. As Conservation Officers are ex-officio Fishery Officers, B.C. Ministry of Environment and Parks staff with the powers of Conservation Officers may issue permits.

However, it has been agreed that:

1) In the Fisheries and Wildlife Branches, B.C. Ministry of Environment and Parks, signing authority for issuing permits will be exercised by Regional Managers, except where they delegate this authority to Conservation Officers, Regional Habitat Protection Biologists or Technicians.

2) In the Federal Department of Fisheries and Oceans, the Regional Director and District Supervisors will exercise the signing authority, except where they delegate this authority to Fishery Officers.

B. Letter of Permit

A standard letter of permit (Attachment 2) will be used by the Ministry of Environment and Parks/Department of Fisheries and Oceans to issue permits under the Order.

Copies of the letters of permit issued should be sent to the Regional Land Manager and the Regional Water Management Branch Engineer for their information, where areas under their jurisdiction may be involved. If the letter of permit is in response to a referral from those agencies, the letter may be returned with the referral.

C. Consultation Between Fisheries Agencies

On streams where both Federal and Provincial fisheries concerns are involved, appropriate action may be taken by the

fisheries agency first contacted by applicants. However, where significant resource values are involved, it is emphasized that interagency consultation (by phone or in writing) or joint inspection must precede final approval. If either agency objects to a proposal, an approval under the Order should **not** be issued.

D. Division of Responsibility

In most parts of the Province, both the Department of Fisheries and Oceans and the Ministry of Environment and Parks may issue letters of permit and communicate as previously noted with the Regional Land Managers and Regional Water Management Branch Engineers. However, in some districts, it may be more expedient to identify those watercourses which will be "administered" solely by one agency.

These arrangements should be developed at the discretion of the Provincial Regional Managers and the Federal District Supervisors, with notice to the Regional Land Manager and Regional Water Management Branch Engineer. For example, in those areas of the Province where the Department of Fisheries and Oceans has no primary resource concerns, such as the Kootenays, the Peace River, and parts of the Okanagan, all letters of permit and communications with Regional Land Managers and Water Management Branch Engineers will be the responsibility of the Fisheries and Wildlife Branches.

The power of Conservation Officers to act as Fishery Officers is limited to non-tidal waters. Therefore, in tidal waters, letters of permit should be issued by District Supervisors of the Department of Fisheries and Oceans or their assignees.

E. Enforcement

Both the Department of Fisheries and Oceans and Ministry of Environment and Parks may enforce the provisions of the Order. In cases of common jurisdiction, it is recommended that each agency consult with its counterpart prior to the laying of charges.

Furthermmore, when dealing with those types of referrals which involve the Land Management Branch, the Water Management Branch, and/or the Mineral Resources Branch, it is recommended that the matter be reviewed with those agencies also.

JP/dl
March 3, 1987
d16append

Government of Canada
Fisheries and Oceans

Gouvernement du Canada
Pêches et Océans

BRITISH COLUMBIA GRAVEL REMOVAL ORDER

made under the

FISHERIES ACT

C.R.C., 1978 c. 841

ORDONNANCE DE LA COLOMBIE-BRITANNIQUE SUR L'ENLÈVEMENT DU GRAVIER

en vertu de la

LOI SUR LES PÊCHERIES

C.R.C., 1978 c. 841

Published under the authority of the Minister/Publication autorisée par le Ministre

Amendment List January 4, 1980

Liste de modifications 4 janvier 1980

ORDER RESPECTING THE REMOVAL OR DISPLACEMENT OF GRAVEL IN OR ABOUT CERTAIN WATERS OF THE PROVINCE OF BRITISH COLUMBIA

Short Title

1. This Order may be cited as the *British Columbia Gravel Removal Order*.

General

2. No person shall remove gravel from, or displace gravel within, the normal high water wetted perimeter of any portion of a stream, river or other body of water that is a spawning ground frequented by fish otherwise than under the authority of and in accordance with a permit in writing issued by the Regional Director or a fishery officer.

3. Without restricting the generality of section 2, no person shall remove gravel from, or displace gravel within, the normal high water wetted perimeter of any of the streams, rivers, river systems or portions thereof set out in the schedule otherwise than under the authority of and in accordance with a permit in writing issued by the Regional Director or a fishery officer.

4. A permit issued under section 2 or 3 shall not be construed as permitting a person

(*a*) to alter the configuration of a river, stream or body of water without permission from the provincial authority having jurisdiction in the matter; or

(*b*) to remove gravel from or displace gravel within a place unless he is the owner of that place or acts on behalf of such owner.

ORDONNANCE SUR L'ENLÈVEMENT OU LE DÉPLACEMENT DU GRAVIER DANS OU À PROXIMITÉ DE CERTAINES RIVIÈRES DE LA COLOMBIE-BRITANNIQUE

Titre abrégé

1. Cette ordonnance peut s'intituler: *Ordonnance de la Colombie-Britannique sur l'enlèvement du gravier*.

Dispositions générales

2. Il est interdit d'enlever ou de déplacer du gravier de tout lieu situé en deçà du périmètre mouillé des hautes eaux d'un cours d'eau, d'une rivière ou de toute autre étendue d'eau qui sert de frayère au poisson, sauf en vertu des conditions d'une autorisation écrite, délivrée par le directeur régional ou un fonctionnaire des pêcheries à l'égard de cet endroit.

3. Sans restreindre la généralité de l'article 2, il est interdit d'enlever ou de déplacer du gravier de tout lieu situé en deçà du périmètre mouillé des hautes eaux de l'un des cours d'eau, rivières ou réseaux hydrographiques ou parties de ceux-ci visés à l'annexe, sauf en vertu des conditions d'une autorisation écrite, délivrée par le directeur régional ou un fonctionnaire des pêcheries à l'égard de cet endroit.

4. Un permis délivré selon les articles 2 ou 3 ne doit pas s'interpréter comme permettant à quiconque

a) de modifier la configuration d'une rivière, d'un cours d'eau ou d'une étendue d'eau sans la permission des autorités provinciales compétentes en la matière; ou

b) d'enlever ou de déplacer du gravier d'un endroit, à moins d'en être le propriétaire, ou d'agir au nom du propriétaire.

SCHEDULE

1. Adams River
2. Alouette River and its tributaries
3. Bear River (flows into Portland Canal)
4. Bella Coola River and its tributaries
5. Bertrand Creek
6. Bessette Creek and its tributaries
7. Big Qualicum River
8. Birkenhead River and its tributaries
9. Campbell River (flows into Semiahmoo Bay)
10. Capilano River
11. Cariboo River
12. Chambers Creek
13. Chapman Creek (flows into Strait of Georgia)
14. Chemainus River and its tributaries
15. Chilcotin River
16. Chilko River
17. Clatse Creek and its tributaries
18. Clearwater River
19. Cluxewe River and its tributaries
20. Coldwater River and its tributaries
21. Coquitlam River and its tributaries
22. Courtenay River
23. Cowichan River and its tributaries
24. Dala River and its tributaries
25. Datlamen Creek and its tributaries
26. Dean River and its tributaries
27. Deena Creek
28. Eagle River (flows into Shuswap Lake)
29. Elk River (flows into Kootenay River) and its tributaries
30. Englishman River
31. Fishtrap Creek (flows into Washington State)
32. Flathead River and its tributaries
33. Fraser River between Sumas River and Hope
34. Gates River and its tributaries
35. Goat River (flows into Kootenay River) and its tributaries
36. Granby River
37. Harrison River
38. Homathko River and its tributaries
39. Honna River and its tributaries

ANNEXE

1. La rivière Adams
2. La rivière Alouette et ses affluents
3. La rivière Bear (tributaire du canal Portland)
4. La rivière Bella Coola et ses affluents
5. Le ruisseau Bertrand
6. Le ruisseau Bessette et ses affluents
7. La rivière Big Qualicum
8. La rivière Birkenhead et ses affluents
9. La rivière Campbell (tributaire de la baie Semiahmoo)
10. La rivière Capilano
11. La rivière Cariboo
12. Le ruisseau Chambers
13. Le ruisseau Chapman (tributaire du détroit de Géorgie)
14. La rivière Chemainus et ses affluents
15. La rivière Chilcotin
16. La rivière Chilko
17. Le ruisseau Clatse et ses affluents
18. La rivière Clearwater
19. La rivière Cluxewe et ses affluents
20. La rivière Coldwater et ses affluents
21. La rivière Coquitlam et ses affluents
22. La rivière Courtenay
23. La rivière Cowichan et ses affluents
24. La rivière Dala et ses affluents
25. Le ruisseau Datlamen et ses affluents
26. La rivière Dean et ses affluents
27. Le ruisseau Deena
28. La rivière Eagle (tributaire du lac Shuswap)
29. La rivière Elk (tributaire de la rivière Kootenay) et ses affluents
30. La rivière Englishman
31. Le ruisseau Fishtrap (tributaire de l'État de Washington)
32. La rivière Flathead et ses affluents
33. Le fleuve Fraser entre les rivières Sumas et Hope
34. La rivière Gates et ses affluents
35. La rivière Goat (tributaire de la rivière Kootenay) et ses affluents
36. La rivière Granby
37. La rivière Harrison
38. La rivière Homathko et ses affluents
39. La rivière Honna et ses affluents

40. Horsefly River
41. Inonoaklin Creek and its tributaries
42. Kanaka Creek
43. Kemano River and its tributaries
44. Kennedy River
45. Keogh River and its tributaries
46. Kettle River
47. Khutzeymateen River and its tributaries
48. Kildala River and its tributaries
49. Kimsquit River and its tributaries
50. Kingcome River and its tributaries
51. Kitimat River and its tributaries
52. Klinaklini River and its tributaries
53. Koksilah River and its tributaries
54. Kwatna River and its tributaries
55. Kwinamass River
56. Lardeau River and its tributaries
57. Lillooet River and its tributaries
58. Little Qualicum River
59. Louis Creek and its tributaries
60. Mamin River and its tributaries
61. Mission Creek (flows into Okanagan Lake)
62. Murray River
63. Naden River
64. Nanaimo River and its tributaries
65. Nass River and its tributaries
66. Nechako River
67. Nicola River and its tributaries
68. Nicomekl River
69. Okanagan River
70. Oyster River
71. Pallant Creek and its tributaries
72. Pitt River and its tributaries
73. Portage Creek
74. Puntledge River
75. Quaal River and its tributaries
76. Quatse River and its tributaries
77. Quesnel River
78. Salmon River (flows into Bedford Channel)
79. Salmon River (flows into Salmon Bay) and its tributaries
80. Salmon River (flows into Shuswap Lake)
81. San Juan River

40. La rivière Horsefly
41. Le ruisseau Inonoaklin et ses affluents
42. Le ruisseau Kanaka
43. La rivière Kemano et ses affluents
44. La rivière Kennedy
45. La rivière Keogh et ses affluents
46. La rivière Kettle
47. La rivière Khutzeymateen et ses affluents
48. La rivière Kildala et ses affluents
49. La rivière Kimsquit et ses affluents
50. La rivière Kingcome et ses affluents
51. La rivière Kitimat et ses affluents
52. La rivière Klinaklini et ses affluents
53. La rivière Koksilah et ses affluents
54. La rivière Kwatna et ses affluents
55. La rivière Kwinamass
56. La rivière Lardeau et ses affluents
57. La rivière Lillooet et ses affluents
58. La rivière Little Qualicum
59. Le ruisseau Louis et ses affluents
60. La rivière Mamin et ses affluents
61. Le ruisseau Mission (tributaire du lac Okanagan)
62. La rivière Murray
63. La rivière Naden
64. La rivière Nanaimo et ses affluents
65. La rivière Nass et ses affluents
66. La rivière Nechako
67. La rivière Nicola et ses affluents
68. La rivière Nicomekl
69. La rivière Okanagan
70. La rivière Oyster
71. Le ruisseau Pallant et ses affluents
72. La rivière Pitt et ses affluents
73. Le ruisseau Portage
74. La rivière Puntledge
75. La rivière Quaal et ses affluents
76. La rivière Quatse et ses affluents
77. La rivière Quesnel
78. La rivière Salmon (tributaire du chenal Bedford)
79. La rivière Salmon (tributaire de la baie Salmon) et ses affluents
80. La rivière Salmon (tributaire du lac Shuswap)
81. La rivière San Juan

82. Serpentine River
83. Seton River and its tributaries
84. Shuswap River
85. Similkameen River
86. Skeena River and its tributaries
87. Slocan River and its tributaries
88. Sooke River
89. South Thompson River
90. Squamish River and its tributaries
91. Stave River
92. Sukunka River
93. Tahsis River
94. Taylor River
95. Teaquahan River and its tributaries
96. Thompson River
97. Toon River and its tributaries
98. Tsolum River
99. Tulameen River
100. Vedder-Chilliwack River System
101. Wakeman River and its tributaries
102. Wap Creek
103. West Kettle River
104. White River (flows into Kootenay River) and its tributaries
105. Wolverine River (flows into Murray River)
106. Yakoun River and its tributaries
107. Yalakom River and its tributaries

82. La rivière Serpentine
83. La rivière Seton et ses affluents
84. La rivière Shuswap
85. La rivière Similkameen
86. La rivière Skeena et ses affluents
87. La rivière Slocan et ses affluents
88. La rivière Sooke
89. La rivière South Thompson
90. La rivière Squamish et ses affluents
91. La rivière Stave
92. La rivière Sukunka
93. La rivière Tahsis
94. La rivière Taylor
95. La rivière Teaquahan et ses affluents
96. La rivière Thompson
97. La rivière Toon et ses affluents
98. La rivière Tsolum
99. La rivière Tulameen
100. Le réseau hydrographique des rivières Vedder et Chilliwack
101. La rivière Wakeman et ses affluents
102. Le ruisseau Wap
103. La rivière West Kettle
104. La rivière White (tributaire de la rivière Kootenay) et ses affluents
105. La rivière Wolverine (tributaire de la rivière Murray)
106. La rivière Yakoun et ses affluents
107. La rivière Yalakom et ses affluents

ATTACHMENT #2

Date:
File:

Dear Sir:

Re:

Note: You are reminded that this letter must not be construed as:

a) permission to alter the configuration of any stream without the approval of the Water Management Branch of the British Columbia Ministry of Environment and Parks;

b) permission to commence any work on Crown Provincial lands without the approval of the Land Management Branch of the British Columbia Ministry of Forests and Lands;

c) permission to commence any work without the approval of other agencies who may have jurisdiction in the matter;

d) permission for any person to trespass or commence any work unless he is the owner of the place involved or acts on behalf of such owner.

This letter shall constitute a permit pursuant to the British Columbia Gravel Removal Order to remove or displace gravel within the normal high water wetted perimeter of the above stream, subject to the conditions indicated here (x):

( ) Reference is made to your letter dated _____.

( ) Any Fishery Officer may alter, modify, or waive at any time the conditions of this permit.

( ) Volume of the gravel removed shall not exceed _____ cubic meters.

( ) The operation shall be completed prior to _____.

( ) The operation shall be undertaken during the period

_____ to _____.
day month year day month year

( ) The following shall be notified at least five (5) days prior to commencement and prior to completion of the operation:

_____

( ) Liaison shall be maintained with the above during the operation.

( ) Proposed or ongoing operations considered detrimental to the fishery resource shall be altered immediately or terminated if so requested by any Fishery Officer.

( ) The operation shall be confined to the area(s) outlined in red on the attachment.

( ) The operation shall be confined to areas which are at an elevation higher than one foot above the water level existing at the time of excavation.

( ) The operation shall be confined to areas which are at an elevation higher than the water level existing at the time of removal.

( ) Machinery and equipment shall not be operated within the wetted perimeter of the stream.

( ) The fording of streams by trucks and construction machinery shall be kept to an absolute minimum and shall be confined to one location.

( ) A culvert or bridge structure of sufficient capacity to ensure safe fish passage shall be provided between the river bank and the instream excavation site.

( ) All stream crossing structures and related approach road fill shall be removed prior to _____ day _____ month _____ year.

( ) Streambank forest cover and vegetation shall not be disturbed or removed.

( ) Overburden, soil, debris, and any other substances deleterious to aquatic life shall be disposed of or placed in such a manner as to prevent their entry into any watercourse.

( ) The operation shall be undertaken in a manner which will not result in the deposition in the stream of silt or other substances deleterious to aquatic life.

( ) Turbid water caused by gravel washing or any other operation shall be passed through a settling basin that meets the Fishery Officer's approval before discharging into any watercourse.

( ) All disturbed areas below the normal high water level of any watercourse shall be graded before inundation so that no new channels or pools are created at higher water levels.

( ) You are requested to sign the attached duplicate of this letter in the appropriate space provided and return same to the undersigned. This permit will not take effect until the signed duplicate has been received by the undersigned. A self-addressed return envelope is enclosed for your convenience.

ADDENDUM (SPECIAL CONDITIONS)

I hereby agree to adhere to the conditions indicated herein.

Signed: _____

Date: _____

This permit has been authorized by: _____

_____

cc: Regional Land Manager _____

Regional Water Management Branch Engineer _____

District Supervisor _____

Regional Habitat Protection Biologist _____

Fish and Wildlife Branch Regional Offices
B.C. Ministry of Environment

Region	Regional Office Addresses	Telephone Numbers
1 Vancouver Island	2569 Kenworth Road Nanaimo V9T 3P7	758-3951
2 Lower Mainland	10334-152A Street Surrey, B.C. V3R 7P8	584-8822
3 Thompson-Nicola	1259 Dalhousie Drive Kamloops V2C 5Z5	374-9717
4 Kootenay	310 Ward Street Nelson V1L 4S4	354-6333
5 Cariboo	540 Borland St. (Box 9000) Williams Lake V2G 1R8	398-4566
6 Skeena	3793 Alfred St. (Box 3250) Smithers VOJ 2NO	847-7303
7 Omineca-Peace	Third Floor-Plaza 400 1011 Fourth Avenue Prince George V2L 3H9	565-6421
8 Okanagan	3547 Skaha Lake Road Penticton V2A 6P1	493-8261

APPENDIX VII: GUIDELINES FOR AERIAL APPLICATIONS OF PESTICIDES IN B.C.

Pesticide Control Branch
Ministry of Environment and Parks

Guidelines for Aerial Applications of Pesticides in B.C.

Introduction

The following guidelines consist of a simple checklist which the Ministry of Environment expects any person to follow in any aerial application of pesticides. The purpose of these guidelines is to ensure that all pesticides applied by air are applied safely to maximize the deposit within the target area and to minimize the possible deposit outside the target area.

Problem

Spray drift is the movement of the finer droplets in a spray cloud out of the target area and the deposit of these droplets into non-target areas. Spray drift is the main problem arising from the aerial application of pesticides and only rarely is it a problem with ground applications.

Solutions

The solutions to the problem of spray drift involve the selection of various forms of methods, equipment, and activities.(Additional problems and solutions would be involved in the transportation, mixing/loading, storage, disposal, and cleanup related to aerial pesticide operations).

(It is assumed that the decision for selecting an aerial method of application instead of other methods has already been made at an earlier stage).

1. Pesticide

   Select a pesticide which is registered for aerial use and select a formulation which has been designed to reduce vaporization (volatility) and spray drift. Select an appropriate drift control agent, if required. Select appropriate equipment and personnel if some of the mixing must be done on location at the airstrip to ensure proper mixing and to minimize spillage and exposure.

2. Aircraft

   Select the type of aircraft (fixed-wing or rotary wing) with the size and capabilities to "fit the job".

   In forestry, helicopters are preferred over fixed-wing where steep terrain is involved.

...2

3. Spray Equipment
Select a boom design, nozzles (type, size, orientation) and a low pump pressure to minimize the potential of spray drift. These factors will be important for achieving many large uniform droplets with few small drifting droplets. Spray equipment should be calibrated with water (or other appropriate diluent) using the intended spray height, swath width and air speed. The addition of a dye will permit observations of spray droplet size and distribution on white cards (e.g. Krome-cote).

4. Timing
Timing should take into consideration the most vulnerable stages of the pest, the least vulnerable stages of non-target species, weather conditions and the availability of all equipment and personnel.

5. Communication/Guidance System
Select a system which may include both audial and visual means of communication to guide the pilot for each swath, to relate progress, to instruct on "cut-offs" and to instruct on "cease operations".

6. Weather Conditons
Monitor weather conditions immediately before and during operations with adequate equipment and personnel, and select weather conditions to reduce drift. Wind conditions at ground level and aloft can be monitored using smoke bombs. The conditions associated with local inversions are usually the optimum periods for preventing drift.

7. Mapping
Select maps and air photos of a sufficient scale to properly understand the target area.

8. Flight Patterns
The selection of flight patterns should take into account the height, air speed, width of swath, weather conditions and related matters. Ensure that no spraying occurs over populated areas and open potable water sources.

...3

In forestry, spray patterns often involve following contours. Flight paths should run parallel with buffer strips and sensitive areas wherever possible.

9. Snags

Prior to the operation, remove all snags and other obstructions which may affect the projected flight height and safety of the operation after consulting with the Fish & Wildlife Branch.

10. Boundary Marking

There are several methods of marking boundaries and buffer zones which require a variety of equipment and personnel. In the case of forestry uses, it is preferable to drop flagging on tops of trees or to spray the margins with whitewash.

11. Monitoring

Select a system from various methods and equipment which will be adequate for monitoring pesticide spray drift. In forestry, cards coated with Krome-cote are usually used. The addition of a dye is a sound practice for all operations where it is practical and where terrain, nozzle selections or other operation variables are difficult to predict.

12. Briefings

All personnel should be thoroughly briefed during one or more meetings prior to the operation as well as on a daily basis during and after operations.

13. Reconnaissance Flight

The pilot, navigator, and other key personnel should make a reconnaissance flight of the entire area to be treated immediately before the operation while the plane contains no pesticide. This would be used primarily to familiarize the pilot with the boundaries, buffer zones and various markers.

...4

Related Concerns

1. Publicity Plan
Besides notification of the intended operation as a condition of the pesticide permit, consider informing the public by radio or other means such as a townhall meeting.

2. Contingency Plans
Contingency or emergency plans must be formulated in the event of a crash, spill, equipment breakdown or other occurrence.

3. Backup Equipment and Staff
For larger operations, it is imperative that backup planes be included.

4. Security Plan
Plans should include the secure storage of pesticides and other key equipment.

5. Safety
Ensure that personnel, including flagmen, are adequately clothed and equipped with safety gear and adequately briefed on the hazards of the pesticide. In large operations, provide for additional water supplies and first aid treatment in case someone is accidentally exposed to a spill of concentrated material. Also provide for adequate fire equipment.

For additional information, contact the local offices of:

1. the Regional Pesticide Control Program, Ministry of Environment,

2. the Regional Fish & Wildlife Program, Ministry of Environment,

3. the Regional Forest Pest Management Program, Ministry of Forests,

4. the Ministry of Agriculture and Food,

5. Environment Canada,

6. Fisheries & Oceans Canada.

...5

Bibliography

1. Health and Welfare Canada, 1975 "Aerial Application of Pesticides - Safety Manual", 160 pages.

2. "Forest Pesticide Handbook of British Columbia", Ministry of Forests, 1984.

3. Warren, L.E. 1976 "Controlling Drift of Herbicides, Part I, 1976; Part 2, 1976, and Conclusion, May 1976, The World of Agricultural Aviation".

4. Chevron Chemical Company, "Application of Paraquat and Diquat by Air".

RWK/bef
October 13, 1983

APPENDIX VIII: EROSION CONTROL PROCEDURE FOR FOREST ROADS AND DEGRADED SLOPES IN B.C.

W. W. Carr

EROSION CONTROL PROCEDURE FOR FOREST ROADS AND DEGRADED SLOPES IN B.C.

William W. Carr[1]

Forest road construction and timber harvesting operations can accelerate surface erosion and mass wasting in watersheds to the extent where there may be negative impacts on other watershed resources, particularly water quality and fishery values. Through proper pre-development planning and the use of high operational standards, some of these problems can be alleviated though not totally controlled. Unforeseen erosion and land stability problems inevitably arise during and, more often, after forest development. The resource manager must take steps not only to minimize off-site impacts but also to control erosion where possible.

1. MINIMIZE OFF-SITE IMPACTS OF EROSION

All erosion from forest roads and harvesting operations cannot be controlled, especially from road surfaces. In such cases, one must rely on downslope sediment storage to reduce movement of eroded material into an active drainage system (Megahan, 1977). Haupt (1959) and Packer (1967) recognized the importance of a buffer/filter strip, and the obstruction within it, in protecting intervening slopes, other downhill roads, and stream channels from road-originated sediment.

1.1 PROCEDURES

1.1.1. The key factors involved in determining buffer strip width are:
- number
- spacing
- type of obstruction

1.1.2. Packer (1967) rated the effectiveness of various obstructions as follows (from most to least effective):
- mounds and depressions
- logs
- rocks
- trees and stumps
- slash or brush
- herbaceous vegetation

1.1.3. The width of a buffer strip can be substantially reduced by installing effective slope obstructions, such as logs, and spacing them closely.

[1]Former contract researcher for B.C. Ministry of Forests, currently Manager - Consulting Services/Research, Terrasol Revegetation Erosion Control Ltd., Vancouver.

2. EROSION CONTROL ON SEVERELY DISTURBED SITES

Next to adequate control of surface and subsurface water, revegation of denuded soil is the most important means of controlling soil erosion. Seeding with grasses and legumes has been proven effective in halting surface erosion from forest road slopes. The planting of shrubs will not only add diversity to the vegetative cover but can enhance slope stability. The deeper, stronger shrub root systems can be effective in improving soil shear strength and thus may alleviate slope stability problems due to soil creep or flow, and shallow shear or rotational failures. Major slope stability problems will require applied engineering technology. Surface erosion and shallow slope failures, if not prevented or controlled, can lead to large-scale mass erosion which cannot be controlled or corrected.

2.1 GRASS-LEGUME ESTABLISHMENT - PROCEDURES

2.1.1. Refer to "A Handbook for Forest Roadside Erosion Control in B.C.", Land Management Report Number 4, available through Information Services Branch, Ministry of Forests.

2.1.2. Seeding should be done as an integral part of every road construction or forestry operation that results in soil denudation.

2.1.3. Before seeding, ensure that slopes are as mechanically stable as possible. Steep slopes can be improved for seeding by:
- reducing slope grades
- benching or terracing slopes
- rounding the top edges of cut slopes
- roughening the soil surface
- deflecting surface runoff
- applying a temporary cover

2.1.4. Seeding methodology: There are two basic methods of grass-legume seeding - dry broadcast application and hydroseeding.

(a) Dry, broadcast application is basically the spreading of seed on the site by hand, by means of a cyclone-type spreader, or by some type of airblast. Both seed and fertilizer can be applied by this method. Once on the slope, the seed and fertilizer are afforded no protection from wind or surface water flow, thus cover establishment can be sporadic. In general, dry seeding for erosion control is limited to slopes 2:1 or less.

(b) Hydroseeding is the application to soil of a seed and water slurry that may contain fertilizer, a chemical soil binder, and/or a mulch. It requires a special application system that must possess a mixing tank with agitation (either mechanical or hydraulic) and volume pumping capability. Although hydroseeding is more expensive than dry seeding, it has been proven very effective in revegetion of slopes up to 1:1 and steeper. On areas inaccessible to conventional truck-mounted hydroseeding equipment, aerial application of the slurry by helicopter is a proven alternative.

2.1.5. General guidelines for selection of method:

(a) Steep slopes, high erosion hazard - hydroseeding, possibly with mulch;
(b) Steep slopes, medium erosion hazard - hydroseeding or dry-seeding plus mulch;
(c) Gentle slopes, medium erosion hazard - hydroseeding or dry-seeding;
(d) Gentle slopes, low erosion hazard - dry seeding.

2.1.6. Problem sites, such as cut and fill slopes in free-flowing sand which do not respond to normal seeding operations, may require the use of erosion control fabrics or netting material. These materials cannot only enhance the structural nature of a site, but also provide immediate slope protection while acting as a mulch for subsequent revegetation.

2.2 SHRUB ESTABLISHMENT - PROCEDURES

2.2.1. Species selection: shrubs selected for use in erosion control programs must meet three main criteria:

(a) Produce the desired effect - i.e., slope stability, short or tall growth form, browse potential, etc.;
(b) Adaptable to site characteristics - particulary soil moisture and fertility;
(c) Ease of propogation - a limited factor in obtaining planting stock.

Whenever possible, shrubs indigenous to the operation area (or surrounding area) should be used.

2.2.2. Information pertaining to the foregoing criteria can be found in "Manual of Plant Species Suitability for Reclamation in Alberta", Volume 11, Report #RRTAC 80-5, Alberta Land Conservation and Reclamation Council, Edmonton.

2.2.3. Propagation method:

(a) Direct planting of unrooted cuttings. This method is primarily suitable for the following species:
- Populus sp.
- Salix sp.

(b) Procedures:

Vegetation requirements - Cuttings should be:
- taken from stock plants native to the areas of operation;
- in the dormant growth phase;
- of previous season's growth;
- straight, healthy and robust.

(c) Cutting procedures - cutting should:
- be taken with a sharp knife or good quality pruning shears;
- have a length of 20 cm or more;
- have a midstem diameter of 10 to 20 mm;
- have at least two healthy buds.

(d) Planting procedures:
- Timing - planting should take place immediately after snow melt or when moisture stress is lowest;
- Planting systems - dependent upon species, selection, planting pattern, and desired species frequency. In general, grid planting is based on a 1-m x 1-m spacing. Linear planting is based on higher plant density within bands spaced 2-10 m apart. Additional information on various planting patterns is available in "Bioengineering for Land Reclamation and Conservation" by Dr. Hugo Schiechtl, the University of Alberta Press, 1980;
- Depth - cuttings should be planted with as little stem exposed as possible and still possess at least two buds;
- Survival rate - in general 30 to 50% mortality can be expected with direct cuttings.

2.2.4. Planting of rooted cuttings - container or bare-root.

(a) This method allows for use of a wider range of shrub species (species listed below have been successfully propagated by Ministry of Forests - Research Branch):

Rubus sectabilis	Salix sp.
Rubus parviflorus	Cornus sericea
Vaccinium parvifolium	Spiraea douglasii
Betula papyrifera	Symphoricarpos albus
Holodiscus discolor	Rosa sp.
Lonicera involvucrata	Alnus sp.
Philadelphus lewisii	Sambucus cerulea
Ceanothus sanguineus	Physocarpus capitatus

(b) Procedure:
- Obtaining stock - rooted planting stock may be obtained through contract/commercial nurseries;
- Container vs bare-root stock - both types of stock have proven very successful in planting operations, bare-roote is cheaper to produce while container stock is easier to handle and offers a longer planting season.

2.2.5. Planting procedures:

(a) Timing - planting is preferred during the dormant season (Nov. - March) but may be extended to June if moisture stress is not a critical factor.
(b) Planting systems - dependant on species selection, planting patterns, and desired species frequency. Both grid and linear planting are possible. In general, few plants are needed with rooted stock due to greater expected survival.
(c) Survival rate - if proper species selection and time of planting are observed, less than 10% mortality may be expected.
(d) Precautions - planting material must not be allowed to dry out during handling prior to planting.

2.2.6. Experience and local expertise are invaluable in the planning of a revegetation program. The B.C. Ministry of Forests, B.C. Ministry of Environment, B.C. Department of Highways and erosion control consultants/contractors are all available to assist the resource manager.

LITERATURE CITED

Carr, W. W. 1980. Handbook for forest roadside surface erosion control. Land Management Report Number 4. B.C. Ministry of Forests, Victoria. 43 pp.

Haupt, H. F. 1959. A method for controlling sediment from logging roads. U.S.D.A. Forest Service Misc. Publ. No. 22. Intermountain For. and Range Exp. Sta., Ogden, Utah. 22 pp.

Megahan, W. F. 1977. Reducing erosional impacts of roads. In: Guidelines for watershed management. FAO Conservation Guide, FAO, Rome. P. 237-261.

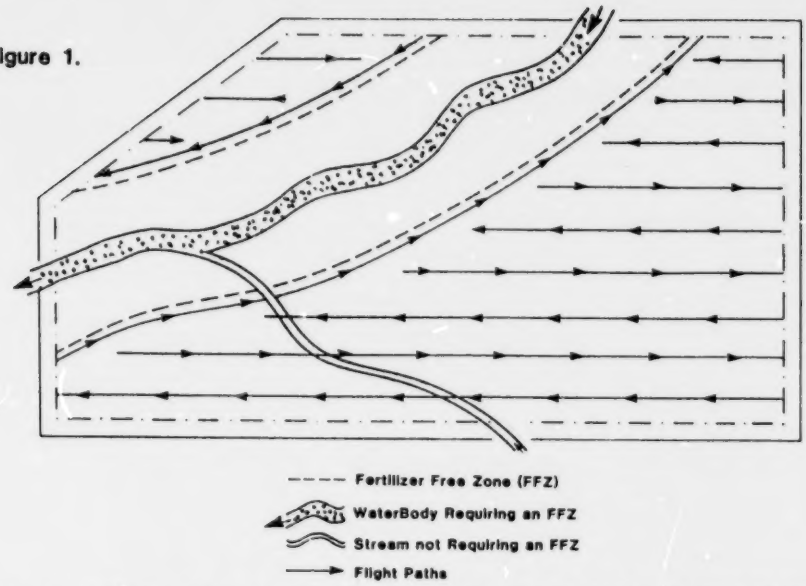
Packer, P. E. 1967. Criteria for designing and locating roads to control sediment. For. Sci. 13(1):2-28.

Schiechtl, H. 1980. Bioengineering for land reclamation and conservation. (Translated by N. K. Horstmann) University of Alberta Press, Edmonton. 404 pp.

Watson, L. E., R. W. Parker, and D. F. Polster. 1980. Manual of plant species suitable for reclamation in Alberta. Volume II. Report #RRTAC 80-5, Alberta Land Conservation and Reclamation Council, Edmonton. 541 pp.

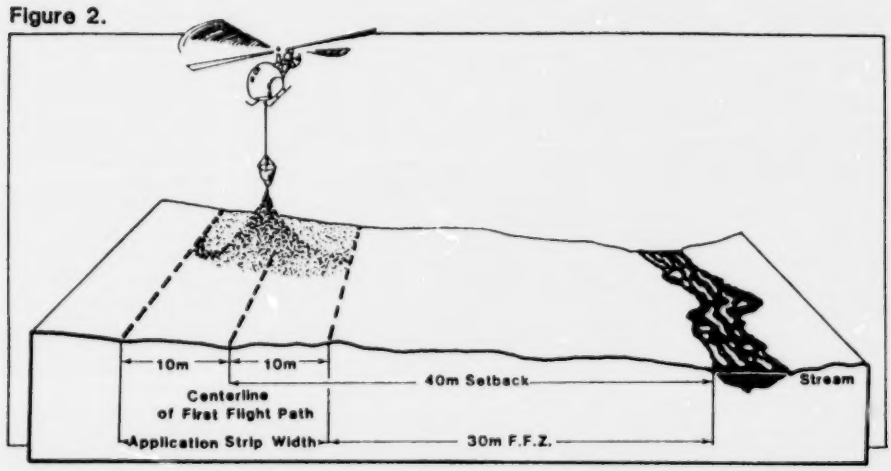
APPENDIX IX: Protection Methods when using Aerial Application of Fertilizer near Fertilizer Free Zones.

Figure 1.



1. Strategy for laying out a fertilizer free zone on a stream included in an area to be fertilized.

Figure 2.



2. Strategy for laying out a 30 metre fertilizer free zone adjacent to a water body in a nutrient sensitive watershed.(see figure 2)

- Fertilizer application strip width is 20 metres or 10 metres on each side of the flight path.
- Fertilizer free zone width is 30 metres.

First flight path should be set back from the water body by a distance of 40 metres.

APPENDIX X: Revised Pre-harvest Silviculture Prescription.

Province of British Columbia
Ministry of Forests
Forest Service

PRE-HARVEST SILVICULTURE PRESCRIPTION
FIELD DATA AND INITIAL PRESCRIPTION

Use to record field data and develop initial prescriptions for individual treatment unit or cut block

TENURE

REGION	F D	LOCATION				T S A	TSB	PROPOSED ha
LICENCE NO		LICENSEE	C P	BLOCK	BCGS OPENING NO	SETTING NO		PLOT NO
PHOTO NO		ASSESSED BY (Print)					DATE D M Y	

SITE

ELEVATION MIN (m)	MAX (m)	ASPECT	PREDOM SLOPE %	SLOPE POSIT	TERRAIN	ROUGHNESS A	B	C	STOCK RED	OTHER

SOIL DESC

SOIL HORIZONS Horizon	Depth	Texture	% C F

Rooting Depth ____ (cm) Restrictive Layer Depth ____ (cm)
Humus Form ____ Soil Order ____
Drainage ____
Landform ____
Other ____

VEGETATION DESC

UNDERSTOREY Species	% Cover	Species	% Cover

SAMPLE TREES

Species				
Crn Cl				
DBH (cm				
Ht (m)				
Age (BH)				
10 yr Gr				
% L Cr				

ADVANCE REGENERATION

Ht	Species	Density	Age	% Accept

ECOLOGICAL CLASSIFICATION
BGC Zone Subzone Var ____
Eco Assn Type Phase ____
Edatopic Grid Moist ____ Nutr ____

Stand Condition ____
Stand Composition ____

PROTECTION

WILDFIRE

LIGHTNING RISK	RECREATION RISK
INDUSTRIAL RISK	OTHER RISKS
ON SITE HAZARDS	ADJACENT HAZARDS
DANGERS	

PEST MANAGEMENT

Agent	Incid	Comments

NON TIMBER VALUES

STREAMS AND LAKES

IN OR ADJACENT TO BLOCK	% Grade	HABITAT POTENTIAL
DOWNSTREAM USE	COMMENTS	

WILDLIFE HABITAT

SPECIES	CURRENT USE
FUTURE IMPACT	RARE ENDANGERED SPECIES

RECREATION

RECREATIONAL FEATURES	POTENTIAL USE
EXISTING USE	EXISTING FACILITIES

LANDSCAPE

VISIBLE FROM	V SENSITIVITY	COMMENT
PRESENT USAGE		

RANGE

RANGE CONDITION	EXISTING IMPROVEMENTS
POTENTIAL USAGE	
COMMENT	

FS 711A-1 SIL 85/2

INITIAL PRESCRIPTION

☐ NOT HARVEST ▶ REASON

☐ HARVEST

SILVICULTURE PRESCRIPTIONS

SUBJECT	DECISION / REASON	ALTERNATIVE
Species selection Stock type		
Stocking Target Regeneration delay (yrs.) Free growing (yrs.)		
Reforestation method		
System / Season / Method of logging		
Site preparation method		
Brushing & weeding		
Stand tending		

PROTECTION

TREATMENT REQUIRED (Pre- During post-harvest) AND / OR LAYOUT CONSTRAINTS

HAZARD REDUCTION REQUIRED ☐ YES ☐ NO

PEST TREATMENT REQUIRED ☐ YES ☐ NO

REC & ESCAPE

MEASURES REQUIRED

RANGE

SEED GRASS | SEED MIX | APPLICATION METHOD | SCARIFICATION REQUIRED

☐ NO ☐ YES ▶

CURRENT GRAZING EFFECTS

PROBABLE PERIOD OF USE

HARVESTING CONSIDERATIONS

ACCESS TO BLOCK

POTENTIAL ROAD CONSTRUCTION AND MAINTENANCE PROBLEMS

EROSION CONTROL

BLOCK LAYOUT

OPENING CONSTRAINTS

ROADS SKID TRAIL AND LANDINGS

OTHER HARVESTING DETAILS

OTHER RESOURCE CONSTRAINTS

OTHER

COMMENTS OR EXTENSION OF A PREVIOUS SECTION

FS 711A-2 SIL 85 2 Use to develop final prescription for individual cutblock on Form 711B Store 711A on opening file

Province of British Columbia

Ministry of Forests

Forest Service

PRE-HARVEST SILVICULTURE PRESCRIPTION

FINAL PRESCRIPTION

Use to develop final cutblock prescription from initial treatment unit prescriptions on Form 711A

TENURE DESC

REGION	F.D.	LOCATION					Y.S.A.	TSB	AREA (ha)
LICENCE NO.		LICENSEE		C.P.	BLOCK	BCGS / OPENING NO. / SETTING NO.			PLOT NO.
PHOTO NO.		ASSESSED BY (Print)			DATE D M Y	ECOLOGICAL CLASSIFICATION			

MGT. OBJ.

STATEMENT

HARVESTING

CUTTING PRIORITY — SEASON / YR. TO START

CONSTRAINTS — SEASON / YR. TO FINISH

LOGGING METHOD

CONSTRAINTS

RECOMMENDED CUTTING SPECIFICATIONS

OPENING SIZE AND CONFIGURATION RATIONALE

ACCESS ROADS TO BLOCK

ROAD LAYOUT IN BLOCK

SKID TRAILS IN BLOCK

LANDINGS IN BLOCK

CULVERTS AND BRIDGES

RANGE/RECREATION/WATERSHED AND FISHERIES CONSTRAINTS

HAZARD REDUCTION — PEST MANAGEMENT

METHOD/TYPE — SEASON / YEAR

PEST TREATMENT

PROTECTION / SITE PREP CONSTRAINTS

PROPOSED USE

MEASURES REQUIRED

PROPOSED USE

SITE TREATMENTS / TIMING

OTHER IMPROVEMENTS

STOCKING STANDARDS

Treatment Unit Identification		TARGETS Stocking Standard (well spaced / ha)	Stocking Method	Leader Growth (cm)	Species Preferred	Species Acceptable	STANDARDS Minimum Stocking (well spaced / ha)	Regen Delay (yr.)	Free Growing Early Years	Free Growing Late Years

SILVICULTURE PLAN

SITE PREPARATION / REFORESTATION

Treatment Units	Season Year	Method	Target Year Sow	Target Year Plant	Selected Species	Selected Stock Type	Selected Stems/ha

GENERAL COMMENTS

BRUSHING AND WEEDING

METHODS TIMING

CONSTRAINTS

GENERAL COMMENTS

GENERAL OBSERVATIONS

PROCESSING SUMMARY

Action	Initial	Date Completed D	M	Y
1 Enter History Record				
2				
3				
4				

☐ MAP PHOTO ATTACHED

MAP SCALE

AFFIX SEAL HERE

Signature of person completing this prescription

Signature of prescription approval (Licensee/ Forest Service R.P.F.)

Signature verifying Government Acceptance

Province of British Columbia

Ministry of Forests and Lands
FOREST SERVICE

PRE-HARVEST SILVICULTURE PRESCRIPTION SHORT FORM

(Use this form to provide a description of a specific cut block and plans for future treatments)

TENURE

REGION	F.D	LOCATION	T.S.A	TSB*	PHOTO NO.*

LICENCE NO	LICENSEE	C.P	BLOCK*	BCGS / OPENING NO / SETTING NO	AREA (ha)

ECOLOG. CLASS

BGC ZONE	SUB ZONE	VARIANT*	ECOSYSTEM ASSOCIATION	TYPE/PHASE*	GRID LOCATION MOIST	GRID LOCATION NUTR	COMMENTS/SUMMARY

PROTECTION PEST MGT

CONCERNS/ACTION

HARVESTING

SILV SYSTEM CLEAR CUT ___ SELECTION ___ SEED TREE ___ OTHER ___ REASON

LOGGING METHOD

LAYOUT CONCERNS

SEASON/YR TO START	SEASON/YR TO FINISH

SILVICULTURE PRESCRIPTION

SITE PREP PRESCRIPTION TIMING

PROTECTION / SITE PREP CONSTRAINTS

REFORESTATION PRESCRIPTION

STOCKING STANDARDS

Treatment Unit Identification	Area (ha)	TARGETS Stocking Standard (well spaced / ha)	Stocking Method	Leader Growth (cm)	Species Preferred	Species Acceptable	STANDARDS Minimum Stocking (well spaced / ha)	Regen Delay (yr.)	Free Growing Early Years	Free Growing Late Years

SEEDLING REQUIREMENTS

Sp	Age Class	Stock Type	Amount (000 0's)	Sow Year	Plant Year
Total					

BRUSHING & WEEDING EXPECTED CONSTRAINTS

OTHER SILVICULTURE CONCERNS

ADMINISTRATION

GENERAL OBSERVATIONS

☐ MAP PHOTO ATTACHED

MAP SCALE

AFFIX SEAL HERE

Prescribed by (Print name)

Signature of person completing this prescription Date

Signature of prescription approval - Licensee R.P.F. Date

NON-TIMBER VALUES - FOR B.C. INTERIOR

IN OR ADJACENT TO BLOCK

STREAMS AND LAKES

% Grade | HABITAT POTENTIAL

DOWNSTREAM USE | COMMENTS

SPECIES

WILDLIFE HABITAT

CURRENT USE

FUTURE IMPACT | RARE / ENDANGERED SPECIES

REC. & LSCAPE

PROPOSED USE

MEASURES REQUIRED

RANGE

SEED GRASS | SEED MIX | APPLICATION METHOD | SCARIFICATION REQUIRED

☐ NO ☐ YES ▸

CURRENT GRAZING EFFECTS | PROBABLE PERIOD OF USE

PROPOSED USE

OTHER IMPROVEMENTS

APPENDIX XI: B.C. Fire Code Regulations for Fuel Storage Tanks.

4.5.1.2. (1) The storage, handling and use of flammable and combustible liquids on farms and construction projects shall conform to Sections 1-3, 1-4 and 1-5 of NFPA No. 395-1984, "Standard for the Storage of Flammable and Combustible Liquids on Farms and Isolated Construction Projects".

(2) Storage areas shall be kept free of weeds and extraneous combustible material. Open flames and smoking shall not be permitted in flammable or combustible liquids storage areas.

(3) The automatic closing valve required in 1-4.3 (c) of NFPA No. 395-1984 does not apply.

Standard for the Storage of Flammable and Combustible Liquids on Farms and Isolated Construction Projects

NFPA 395-1984

1-1 Scope.

1-1.1 This standard applies to the storage on farms or in rural areas of flammable and combustible liquids having a flash point below 200°F (93.3°C) (as defined in NFPA 30, *Flammable and Combustible Liquids Code*). It is also applicable to the storage of flammable and combustible liquids at rural construction and rural earthmoving projects, including gravel pits and borrow pits, where it is customary to obtain fuels in bulk and dispense or transfer them under control of the owner or contractor, and where isolation from other structures and temporary use make it unnecessary, in the opinion of the authority having jurisdiction, to require compliance with the more rigid standards of NFPA 30.

1-1.2 This standard does not apply to (a) the storage, handling and use of fuel oil tanks and containers connected with oil burning equipment as covered in NFPA 31, *Standard for the Installation of Oil Burning Equipment*, (b) storage of 25 gal (95 L) or less of flammable and combustible liquids in containers not exceeding 5 gal (19 L) capacity each.

1-2 Types of Approved Storage.

1-2.1 Storage of flammable and combustible liquids in rural areas for private use shall be permitted in any of the following:

(a) In aboveground or underground tanks or in containers in accordance with NFPA 30;

(b) In containers of 60 gal (227 L) or less capacity each in accordance with Section 1-3 of this standard;

(c) In tanks of 61 to 1,100 gal (231 L – 4164 L) capacity each in accordance with Section 1-4 of this standard.

1-2.2 Storage areas shall be kept free of weeds and extraneous combustible material. Open flames and smoking shall not be permitted in flammable or combustible liquids storage areas.

1-3 Individual Containers of 60 Gallons or Less Capacity Each.

1-3.1 Storage shall be in metal DOT or other approved containers of 60 gal (227 L) or less capacity each. Discharge devices requiring pressure on the container are prohibited. Pumping devices or faucets used for dispensing flammable and combustible liquids shall be well maintained to prevent leakage. Individual containers shall not be interconnected and shall be kept closed when not in use.

1-3.2 Containers as provided in this section storing Class I flammable liquids shall be stored outside at least 10 ft (3 m) from any building or may be stored inside a building used exclusively for the storage of flammable and combustible liquids and located at least 10 ft (3 m) from any other building. Buildings used for the storage of Class I flammable liquids shall be provided with cross ventilation with at least 2 vents of 64 sq in. (645 sq mm) of area each placed at floor level.

1-4 Tanks of 60 to 1,100 Gallons Capacity Each.

1-4.1 Flammable and combustible liquids in aboveground tanks of 60 to 1,100 gal (227 L to 4164 L) capacity shall be stored outside buildings in tanks of single-compartment design constructed in accordance with accepted engineering practice. Joints shall be riveted and caulked, riveted and welded, or welded. Tank heads over 6 ft (2 m) in diameter shall be dished, stayed, braced or reinforced. Tanks shall meet the following:

Capacity		Minimum Thickness of Steel
Gallons	Liters	Mfgrs. Std. Gage No.
60 to 560	231 to 2120	14
560 to 1,100	2120 to 4164	

1-4.1.1 A fill opening shall be provided and shall be equipped with a closure designed so that it may be locked. The fill opening shall be separate from the vent opening.

1-4.1.2 Each tank shall be provided with a free opening vent of the following minimum nominal pipe size to relieve vacuum or pressure which may develop in normal operation or from fire exposure.[1]

Tank Capacity		Vent Size	
Gallons	Liters	Diameter Inches	Millimeters
Up to 275	1040	1¼	38
275 - 660	1040 - 2498	2	50.8
660 - 900	2498 - 3407	2½	63.5
900 - 1100	3407 - 4164	3	76.2

Vents shall be arranged to discharge in such a way as to prevent localized overheating of, or flame impingement on, any part of the tank in the event vapors from such vents are ignited.

1-4.1.3 Tanks as provided in this section shall be kept outside and at least 40 ft (12.2 m) from any building, and shall be so located, or such additional distance from buildings shall be provided, as will ensure that any vehicle, equipment, or container being filled directly from such tank will be at least 40 ft (12.2 m) from any building.

1-4.1.4 Tanks as provided in this section may be either tanks with top openings only or tanks elevated for gravity discharge.

[1]Based upon limiting internal tank pressure to 120 percent of 2.5 psig using an orifice coefficient of 0.8 and an environmental factor of 0.5. The environmental factor of 0.5 recognizes the limited time a small tank is subjected to fire exposure, loss of fuel by absorption into the soil and the drainage of liquid away from the tank. Calculation methods are based upon NFPA 30, *Flammable and Combustible Liquids Code*, subsection 2-2.5, Emergency Relief Venting for Fire Exposure for Aboveground Tanks.

1-4.2 Tanks with Top Openings Only. Tanks constructed and located as provided above may be designed with all openings in the top of the tank and in such event shall be mounted and equipped as follows:

(a) Stationary tanks shall be mounted on timbers or blocks approximately 6 in. (152 mm) in height so as to protect the bottom of the tank from corrosion from contact with the ground and, when so placed, be in a stable position; or, movable tanks may be equipped with attached metal legs resting on shoes or runners designed so that the tank is supported in a stable position and so that the entire tank and its supports may be moved as a unit.

(b) Tanks shall be equipped with a tightly and permanently attached approved pumping device having an approved hose of sufficient length for filling vehicles, equipment or containers to be served from the tank. Either the pump or the hose shall be equipped with a padlock to its hanger to prevent tampering. An effective antisiphoning device shall be included in the pump discharge unless a self-closing nozzle is provided. Siphons or internal pressure discharge devices are prohibited.

1-4.3 Tanks Elevated for Gravity Discharge. Tanks constructed and located as provided above may be designed with a connection in the bottom or the end of the tank for gravity dispensing of flammable and combustible liquids and shall be mounted and equipped as follows:

(a) Supports to elevate the tank for gravity discharge shall be of adequate strength and design to provide stability. Supports may be of steel or of wood.

(b) Alternately, the tank may be placed on a pile of earth or near the edge of a cut bank to provide the necessary elevation, and shall be supported on timbers or blocks for stability and to prevent corrosion by contact with the ground.

(c) Bottom opening for gravity discharge shall be equipped with a valve located adjacent to the tank shell which will close automatically in the event of fire through the operation of an effective heat actuated releasing device. If this valve cannot be operated manually, it shall be supplemented by a second valve which can be. The gravity discharge outlet shall be provided with an approved hose equipped with a self closing valve at the discharge end, of a type that can be padlocked to its hanger to prevent tampering.

1-5 Marking of Tanks and Containers. Tanks and containers for the storage of flammable and combustible liquids aboveground shall be conspicuously marked with the name of the product which they contain and "FLAMMABLE — KEEP FIRE AND FLAME AWAY." Tanks of 60 to 1,100 gal (227 L — 4164 L) capacity shall bear the additional marking "KEEP 40 FEET (12.2 M) FROM BUILDINGS."

NOTE: Clearance of 40 ft (12.2 m) from buildings should also apply to other combustible structures, haystacks, etc.

1-6 Mandatory Referenced Publications. This section lists publications which, in whole or in part, are part of the requirements of this document.

1-6.1 NFPA Publications. The following publication is available from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

NFPA 30-1984, *Flammable and Combustible Liquids Code*.

APPENDIX XII: Glossary

GLOSSARY

Abandoned Roads
: Permanently non-active roads, not required for vehicle access.

Active Logging Roads
: Those used for the ongoing development and extraction of timber.

Anadromous
: Fish which breed in freshwater but live their adult life in the sea. On the Pacific coast, anadromous fish include all the Pacific salmon, steelhead trout, some cutthroat trout and Dolly Varden char, lampreys, and eulachons.

Anadromous or Sportfish Potential
: Refers to the productive capability of a stream reach to support anadromous or resident sport fish whether or not fish are or have been present. Physical stream reach characteristics (eg. gradient, water flow, depth and temperature, spawning gravel, etc.) are compatible with those required for fish production. The absence of fish may be attributed to natural or manmade barriers, the absence of a specific feature required for one life history phase (eg. spawning gravel) or an earlier catastrophic event. Agency stock management goals or stock enhancement activities should guide the determination of priority or level of protection afforded these areas.

Alevin
: A stage of embryonic development of salmon or related fish referring to fish recently hatched from the egg and before absorption of the yolk sac and emergence from the spawning gravel.

Alluvial (see Fluvial)

Back Channel (see Channel and Side Channel)

Bank
: The rising ground bordering a stream channel below the level of rooted terrestrial vegetation and above the normal stream bed. In entrenched channels the stream bank and the valley wall may coincide. The left (L) and right (R) banks are defined looking downstream. In the absence of vegetation, (i.e. incised channels) mean annual high water level defines the top of the bank.

Basin (see Watershed)

Bedload
: Particulates which are transported along the channel bottom in the lower layers of streamflow by rolling and bouncing.

Benthos
Organisms, both plant and animal, living in direct association with the substrate of a water body (freshwater, estuarine and marine).

Blowdown (Wind Throw)
Uprooted by the wind. Also refers to a tree or trees so uprooted.

Bole
The stem of a tree, once it has grown to substantial size.

Boulders
Rounded inorganic bed or bank material with its intermediate diameter greater than 256 mm.

Braiding
A pattern of river bars with numerous interconnected small channels at lower flows caused by high volumes of bed material in transport.

Buffer Strip (see Leave Strip)
Vegetation fringe left intact along a stream, river or lake after logging. Can be deciduous or a mix or deciduous and coniferous species, including a complete assemblage of natural forest.

Buffer Zone
A strip of land between a pesticide free zone and the treatment area. The purpose of the bufferzone is to prevent entry of residues of the applied material by drift, runoff, or leachate into the pesticide free zone. Although pesticides are not applied directly to the bufferzone, some pesticides may be deposited in the zone by drift, runoff or leaching. The width of the bufferzone necessary to maintain the pesticide free zone is up to the discretion of the applicator who must take into account the type of application, terrain and weather conditions.

Canyon
A deeply intrenched, steep-walled valley, frequently in bedrock.

Cavity Nesting Birds
Birds that nest in holes in trees.

Channel
A waterway of discernable extent which continuously or periodically contains moving water, and has a defined bed and banks.

Channel Width
The width of the channel from rooted vegetation to rooted vegetation. Mean annual high water level is used in the absence of vegetation.

Channelization
Zones of artificially stabilized or diverted channels, usually resulting in a straighter and deeper channel.

Clearcutting
A silvicultural system in which the crop is cleared from a considerable area (generally more than a few acres) at one time.

Cobble
Bed or bank material between 64 and 256 mm in intermediate diameter.

Compaction
The relative density of bed material, usually caused by sedimentation, mineralization or imbrication.

Coniferous
A cone-bearing tree or shrub, including larch or tamarak.

Coppicing
The tendency of certain tree and brush species (ie: alder, big leaf maple) to produce a large number of shoots when a single or few stems are mechanically removed, but the root system is left intact.

Cover
With reference to aquatic habitat, the plants, rocks and other materials (including organic debris) used by fish for shelter and protection from adverse conditions and predation.

Creeks
Small streams.

Cutblock
Specific area planned for timber harvesting, as described in the Cutting Plan.

Cutting Plan
A plan for harvesting the timber from an area defined within a cutting permit. This plan must be aproved by the Ministry of Forests before operations may begin.

Debris (Organic)
Logs, trees, limbs, branches, bark, and other woody material that accumulates in the floodplain, streams or other water bodies. May be naturally occurring or the result of logging.

Large Debris - Includes tree boles, "chunks" (which are pieces with 6 inches diameter and 12 feet long) or stumps.

Small Debris - Pieces smaller than chunks and down to branches.

Fine Debris - Accumulations of coniferous needles, deciduous leaves, etc., and twigs.

Debris Flow/Torrent
Debris flows and torrent flows are rapid mass movements of inorganic and/or organic material with sufficient water content for fluid behaviour. Debris and torrent flows frequently, leave long linear tracks scoured clean of all vegetation and loose surface material, especially in drainage channels.

Debris Transport Capability
The capability of a stream to transport organic debris or sediment which is deposited in the stream channel at some seasonal flow. Flows sufficient to transport debris may not occur every year.

Deciduous
All non-coniferous riparian vegetation, including evergreen broadleaved trees (e.g. Arbutus menzesii).

Detritus
Disintegrated animal and plant material; before decomposition to basic nutrients.

Discharge
The rate of flow or volume of water flowing in a given stream at a given place and within a given period of time.

Drainage Structures
Includes metal and wooden culverts, open-faced culverts, bridges, and ditches.

Drift
Voluntary of accidential dislodgement of aquatic insects from the stream or river bottom onto the water column where they become more available as food items for fish.

Ecosystem
Any complex of living organisms together with all the other biotic and abiotic (non-living) factors which affect them. For example, a forest ecosystem is that part of a forest area which is uniform in climate, parent materials, physiography, vegetation, soils, animals and micro-organisms.

Environmental Sensitive Area (ESA) Program for Timber Supply Areas
ESA's for forestry include potentially fragile or unstable soils that may deteriorate unacceptably after forest harvesting, and areas of high value to non-timber resources such as fisheries, wildlife, water, and recreation.

Ephemeral Stream

Refers to flows of water which occur only after precipitation or snowmelt.

Estuary

A semi-enclosed body of water which has a free connection with the open ocean and within which sea water is measurably diluted with freshwater derived from land drainage (Cameron and Pritchard, 1963).

Falling

The cutting down of individual trees in a logging operation.

Fertilizer Free Zone (FFZ)

The area surrounding a water body which is intended to be free of fertilizer pellets. Although some fertilizer may enter the zone, it will ensure that there is not direct deposition of fertilizer into the water body and also minimize the leaching of fertilizer into the water body.

Fertilizer Free Zone Widths

Fertilizer Free Zone widths will be 10 metres in non-senitive watersheds and 30 metres in nutrient sensitive watersheds.

Water Bodies Requiring a Nutrient Fertilizer Free Zone

Those which are described as follows:

- a lake
- a Class I or Class II mainstem channel, or
- a channel that can be identified, on a pre-flight inspection, as one which will be observable as open water at the time of application and flows into Class I or Class II water bodies.

A water body which has open water, but may not be observable as such at the time of application, may require flagging to assist in identification for buffering purposes.

50 percent Rule

Established in the Coast Logging Guidelines of 1972, "no more than 50 percent of a stream or lake face will be opened during one phase."

Fines

Bed or bank material less than 2 mm in diameter: includes sand, silt, clay and fine organic material.

Fish Habitat

Spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.

Fisheries Official

An employee of the British Columbia Fisheries Branch or the federal Department of Fisheries and Oceans.

Fisheries Sensitive Zones
Aquatic environments which are important for the life history of fish, including areas which may not be defined as streams. Fisheries sensitive zones may include side and flood channels, valley wall ponds, swamps, seasonally flooded depressions, lake littoral zones or spawning areas, estuaries and recreationally fished areas.

Marine Sensitive Zones include herring spawning areas, shellfish beds, marsh areas, juvenile salmonid rearing areas and adult salmon holding areas.

5-Year Development Plan
A plan prepared by the forest industry which outlines the cutting pattern and road layout for a particular sub-unit (often watersheds) over a 5-year period).

Flood Channels
Channels which contain water at high mainstem flow levels.

Flood Plain
Flat land bordering a stream or river and subject to flooding; underlying materials consist mainly of unconsolidated material derived from sediments transported by the stream.

Fluvial
Refers to materials that are transported and deposited by running water.

Food Chain
Series of organisms inter-related in their feeding habits, the smallest being fed upon by a larger one, and so on. Typically consisting of producers (plants), and consumers (animals) including herbivores (plant-eaters) and carnivores (animal-eaters).

Forest Licence
A licence authorizing harvesting on Crown Lands under the Ministry of Forests Act. The licence has a specific term and specifies an Annual Allowable Cut, requires a Management and Working Plan, and specified management activities.

Freshet
A sudden rise in the level and volume of a stream or river, due to heavy rains or rapid melting of snow and ice.

Fry
The young stage of fishes, particulary after the yolk sac has been absorbed.

Girdling
Removing the bark and some of the cambium around the circumference of a tree in order to kill the tree.

Gradient (stream)
The general slope, or rate of vertical drop per unit of length, of a flowing stream.

Gravel
Inorganic bed and bank material between 2 and 64 mm in diameter measured across the intermediate axis. Small (2-16 mm) and large (16-64 mm) gravel may be distinguished.

Gully
Erosion features in valley walls resulting principally from running water.

Gullying
The formation of gullies.

Habitat
Generally, the place where an organism lives. Pertains to the conditions found at such locations, including the physical, chemical, and biological features such as substrate, cover, water and food.

Hydrology
The science of water, its movement over and under the land surface and its properties.

Hydrologic Cycle
The circulation of water from ocean to atmosphere to earth and back to the ocean.

Inactive Logging Roads
Defined as either Limited Access Roads or Abandoned Roads.

Injection
Application of herbicide to a tree through a cut in the bark. Hack and Squirt is one of these methods.

Integrated Resource Management
The process of setting goals, objectives, strategies and policies in a cooperative framework among all watershed resourcs and resource uses.

Intermittent Stream
A stream with a defined channel, but which is dry for periods of the year; usually the late summer and fall period of low precipitation and no snow melt.

Invertebrates
Animals without backbones. In aquatic systems, includes insects, crustanceans, shellfish, and worms.

Landform
A landscape unit that denotes origin and shape (for example, flood plain, river terrace, and till plain).

Large Organic Debris (LOD)
Entire trees or large pieces which provide channel stability or which create fish habitat diversity in a stream channel.

Leaners
Those trees along the streamside which lean out over the stream and which cannot be felled safely away from the stream with conventional unassisted falling practices.

Leave Strip
Natural vegetation fringe left along a stream, river or lake margin or between cutblocks after logging.

Limited Access Roads
Designed for access only for forest protection and silviculture. Re-openable as harvest roads for the next crop.

Litter Layer
The layer or organic debris, mainly bark, twigs, and leaves on the forest floor.

Logging
Forest havesting activities including falling, yarding and hauling (as well as road building) associated with these activities.

Low Flow Discharge
The lowest discharge recorded over a specified period of time, usually one year. It often occurs in late summer or early fall.

Low Numbers
A Class II stream reach (which may or may not receive recreational use) in which the inherent capability of the reach controls and limits the number of fish that it can support. Numbers are generally below a level which would provide the currently (1984) acceptable recreational opportunity (1 fish/day).

Major Class II or III
The intent is to apply conservative guidelines for large streams which could impact the land base if channel or bank disturbance occurs.

Major Class III or IV
Streams which, because of their size, capacity to transport material, and erosion potential, would be treated as rivers (e.g. Cameron River, or Kennedy River above the falls).

Management and Working Plan
A plan for managing a forest. A statutary requirement for Tree Farm Licences, Forest Licences and Woodlot Licences; usually for a period of 5 years. In TFL's, they cover operations on all tenures within the licence and include inventory data and allowable cut calculations.

Marine Sensitive Zones
See Fisheries Sensitive Zones.

Mass Wasting (Landslides)
The downslope movement of masses of soil and organic matter under the influence of gravity. Sub categories include debris slides, debris avalanches and rockslides.

Merchantable Trees
Those trees which Crown considers to be marketable.

Migration
Deliberate movement from one habitat to another. Includes the downstream movement of young salmonids from streams to sea and upstream movement of adult spawners to spawning streams.

Monitoring
Part of field surveillance, involving the assessment of environmental protection performance and the measurement of environmental impacts.

Moving Debris
Debris, either natural or logging, which will move downstream during periods of high water. It is not anchored in place and usually not covered with mosses or algae. See also debris.

Natural Vegetation
For the purposes of logging guidelines, it includes immature or non-merchantable conifers, deciduous trees, shrubs and ground cover species.

Non-Merchantable Trees
These trees which the Crown does not consider to be marketable.

Nutrient Sensitive Watersheds
Nutrient sensitive watersheds are those where:
- nitrogen/phosphorus fisheries productivity research is ongoing, or
- effluents containing phosphorus are discharged into the system.

If a municipal, industrial, or hatchery outfall or a nutrient rich agricultural discharge is present on a system with the potential for a negative impact on fish production or a recreational fishery through the addition of fertilizer nitrogen, then the watershed is considered to be sensitive. Nitrogen saturated systems may be considered for urea fertilization.

Obstruction (Blockage)
Any object or formation of debris which impedes or blocks water flow and/or fish migration.

Operation Plan
The final level of planning in the Ministry of Forests hierarchical planning system; a plan detailing the logging

techniques, location of roads and landings, and outlining other matters related to forest harvesting and forest crop renewal.

Patch Cutting
A type of clearcutting used for even-aged management in which the cleared areas may be as small as a few acres in size and separated by uncut timber.

Perennial Stream
A stream which has flowing water all year.

Pesticide
Any substance or mixture of substances, other than a device, intended for killing, controlling or managing insects, rodents, fungi, weeds and other forms of plant or animal life that are considered pests.

Pesticide Fee Zone (p.f.z.)
A strip of land, usually 10 meters in width, adjacent to a stream or waterbody and measured from the high watermark. The applicator must prevent, as far as possible and to his utmost ability, the entry of pesticides, by direct application, drift, runoff, or as a leachate, into the pesticide free zone. It is recognized that very low levels (parts per billion or trillion) are commonly found in all areas with new detection technologies. However, the pesticide free zone is to be maintained by the professional capabilities of the applicator who is qualified to make the necessary judgements regarding equipment, terrain, and weather conditions. Specific authorization is needed if the Pesticide free zone is to be less than 10 meters.

Pesticide Use Permit
A Pesticide Use Permit must be obtained from the Pesticide Control Branch to apply a schedule I, II, III, or IV pesticide to a body of water other than one that is man made and self contained; to public land; or to land used for transportation or public utility purposes.

Pistol Butt Trees
Trees with a sweep or bow in the butt.

Planning
The determining of the goals and objectives of an enterprise, and the selection, through a systematic consideration of alternatives, of the policies, programs and procedures for achieving them. An activity devoted to clearly identifying, defining and determining courses of action necessary to achieve predetermined goals and objectives.

Pool
Section of a stream or river of considerable depth for the size of stream, usually with slowly flowing water and a smooth surface.

Pool-Riffle Ratio
The ratio of the total length of riffle divided into the total length of pool. This ratio is a measurement used to predict the stream's capability of providing resting and feeding pools for fish and riffles to produce food and support spawning. The common interpretation is that a ratio of 1 to 1 is optimum.

Population
A group of individuals of any species in a location or area.

Potential
See Anadromous of Sportfish Potential.

Primary Production
The photosynthetic process by plants whereby nutrients and sunlight are converted to carbohydrate food.

Producer
A plant producing carbohydrate food from carbon dioxide, nutrients and sunlight.

Productive Lake Littoral Zone
The shallow or shoal area around a lake where the penetration of light to the bottom permits plant and associated invertebrate production.

Provincial Forest
A forest land designation whereby areas are set aside for timber production. The uses of Provincial Forests include timber production, forage production, forest recreation, and water, fisheries, and wildlife resource purposes.

Rain-on-snow
A precipitation and runoff event in which rapid snowmelt is augmented by rainfall.

Raptors
Birds of prey, including eagles, vultures, osprey, hawks, owls, and falcons.

Reach
A relatively homogeneous section of a stream having a repetitious sequence of physical processes and habitat types.

Rearing (Fish)
Adj. Growing; usually pertaining to younger stages - fry and juveniles.

Verb. The early life activities of growth and survival, including feeding, territorial defence, and respiration.

Referral
The process whereby applications for permits, licences, leases, etc. which are made to one Government agency by an individual or industry are given to another agency for review and comment. For example, the Fisheries and Oceans review of a Cutting Plan Application is part of the Ministry of Forests/Department of Fisheries and Oceans referral process.

Regional Plan
The intermediate planning level in the Ministry of Forests hierarchical planning system. The Regional Forestry Plan contains forest management alternatives based on a detailed analysis of timber supply within the region. Regional priorities for integrated uses are identified anid taken into account in setting production goals for timber, range and forest recreation.

Resident Fish (see Anadromous Fish, Sport Fish)
Fish that remain in fresh water; non-anadromous.

Resident Sport Fish
A non-anadromous fish which is large enough to be recreationally used pursuant to the British Columbia Sport Fishing Regulations.

Resource Folio
A collection of resource capability and forest inventory maps, other resource data, interpretations, and management objectives for each resource sector. General prescriptions are developed to achieve the stated use objectives. A Resource Folio forms the basis for the timber licensee's development.

Riffle
A section of stream or river of shallow depth and rapid current with surface flow broken by gravel, rubble, or boulders. Usually separated by deeper pools.

Riparian Zone
The stream bank and flood plain adjacent to streams or water bodies, with particular reference to the vegetation.

Rivers
Large streams.

Salmonid
Of the Salmonidae family of fishes; including the Pacific salmon, trout and char.

Sand
Inorganic bed or bank material between 0.062 and 2 mm in diameter.

Sedimentation
The process of subsidence and deposition of suspended matter carried in water by gravity; usually the result of the reduction of water velocity below the point at which it can transport the material in suspended form.

Senescent
The dormancy phase of perennials.

Sidechannels (see Fisheries Sensitive Zone)
Channels within the flood plain connected to the main stream at high flow levels; they may or may not be connected at low flows, and are characterized by much lower current velocities.

Silt
Inorganic bed or bank material between 0.004 and 0.062 mm in diameter.

Silvicultural Practices
Maintenance of the productivity of forest land and sites, restocking of denuded forest lands with commercial species, protection against fire, insects and diseases to predeterminal standards. As used as a section heading in the guidelines, this term is confined to logging, waste disposal, fertilization and biocide application.

Slashing
This method includes brush saw treatment but it generally refers to any cutting of brush lower than approximately 3 meters in height.

Slide
A mass movement process in which slope failure occurs along one or more slip surfaces and in which the unit generally disintegrates into a jumbled mass en route to its depositional site. A debris flow or torrent flow may occur if enough water is present in the mass.

Slope
The angle of the land surface with respect to the horizontal; expressed as percent or degrees.

Slump
A mass movement process in which slope failure occurs on a usually curved slip surface and the unit moves downslope as an intact block, frequently rotating outward. Slumps appear as discrete block movements, often in place, whereas slides usually break up and travel downslope.

Smolt
A one-or-more-year-old juvenile salmonid having undergone physiological changes to cope with a marine environment. Usually refers to the downstream migrants of fish in this conditions, or those salmonids (coho, chinook, and sockeye salmon, and steelhead and cutthroat trout) exhibiting silvery colouration and downstream movement to sea.

Snag
A standing dead tree.

Special Use Permit
A permit from the provincial Ministry of Forests for use of upland areas for special purposes; usually concerning log handling activities.

Sport Fish (See Anadromous Fish, Resident Fish)
Fish which are recreationally pursued. These include anadromous fish and larger resident fish, often found in lakes, and in streams of lower gradient and higher productivity which are often accessible to a larger stream or a lake.

Stable Debris
That portion of debris within or adjacent to the stream channel which is very unlikely to be moved, even at high flows. Stable debris is usually embedded in or attached to the bed or bank and forms a part of the stream's morphologic character.

Stream
The watercourse formed when water flows between continuous definable channel boundaries. Flow in the stream channel may be perennial or intermittent.

Stream Channel
The stream bed and banks formed by fluvial processes, including deposited organic debris.

Stream Order
A system of numbering stream segments as part of a drainage basin network. First-order streams have no tributaries; those that receive only first-order segments are second-order; segments that receive first and second order tributaries are designated third-order, and so on.

Streambank
The rising ground bordering a stream channel.

Streambed
The bottom of the stream below the usual water surface.

Streamside
The land, and the vegetation it supports, immediately in contact with the stream or sufficiently close to it to have a major influence on, or to be influenced by, its ecological character.

Streamside Management Zones
The land, together with the vegetation it supports, immediately in contact with the stream and sufficiently close to have a major influence on the total ecological character and functional processes of the stream. The size and configuration of each streamside management zone can only be determined by site-specific analysis. On Class I and Class II, these would be determined using the same criteria. On Class III and Class IV reaches of

significant width with potential for bank and channel erosion problems, similar criteria and zones would be required.

Stubbling
Mechanically slashing brush and treating the remaining "stubble" with a herbicide.

Substrate
The materials making up the streambed; usually described as bedrock, boulders, cobbles, gravels, sands, and silts. Also includes organic material.

Sub-Unit Plan
An intermediate level of planning in the Ministry of Forests hierarchical planning system. The aggregation of a number of courses of action in map and written form designed to achieve subunit objectives. Normally centred on watersheds.

Surficial Materials
Naturally occurring unconsolidated materials including soil which covers the earth's surface.

Surveillance
The overall observational and measurement program, involving monitoring of environmental policies and impacts, and inspection and enforcement of specific measures and requirements.

Texture
The make-up of surficial materials by particle size and shape.

Timber Operability
The economic suitability of timber for harvesting. Parameters to consider in assessing operability include terrain, timber quality, timber size, operating season, labour costs, development costs, and transporation costs. In the Environmental Protection Area program, operability refers to freedom from harvesting constraints which include access, environmental protection and other forest uses.

Timber Sale Licence (TSL)
A licence authorizing timber harvesting on Crown land under the Ministry of Forests Act for a term not exceeding 10 years.

Timber Supply Area (TSA)
An area defined by a established pattern of wood flow from management units to the primary timber-using industries.

Time Phase Sequence
Scheduling the removal of streamside deciduous tree species over a period of years such that adequate levels of cover and inputs of nutrients, detritus, and terrestrial insects will be maintained. The extent at which vegetation may be treated will depend on the regeneration recovery time of adjacent previously treated areas.

Tree Farm Licence (TFL)
Privately managed forestry units. Designed to enable owners of Crown-granted forest lands and old temporary tenures or the timber licences which replace them, to combine these with enough unencumbered Crown land to form self-contained sustained yield management units. These licences commit the licensee to manage the entire area under the general supervision of the Ministry of Forests. Cutting from all lands requires Ministry approval through the issuence of Cutting Permits. Tree Farm Licences should not be confused with Certified Tree Farms under the Taxation Act. A TFL has a term of 20 years.

Topographic Break
A distinct change in the slope of the land.

Topography
A general term to include characteristics of the ground surface such as plains, hills and mountains, degree of relief, steepness of slopes, and other physiographic features.

Unavoidable
In this proposed stream classification unavoidable adverse effects refer to those ecological changes to the stream ecosystem which even the best possible forest harvesting process may cause (e.g. the replacement of large old growth trees with smaller second growth trees). It specifically does not include effects due to measures or the lack of measures dictated by cost considerations.

Unstable Banks
Stream banks, or valley walls entering the channel, which are actively failing.

Velocity
The rate of water movement in m/s.

Watershed
The entire basin area drained by a stream or lake.

Watershed Management
The managment of the natural resources of a drainage basin for the production and protection of water supplies and water based resources (including fish).

Yarding
In logging, the hauling of felled timber to the landing or temporary storage site from where trucks (usually) transport them to millsite. Yarding methods include cable yarding, ground skidding, and aerial methods such as helicopter and balloon yarding.